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Richard Rathbun,
Assistant Secretary, Smithsonian Institution, in charge of the United States National Museum.

March, 4, 1916.

TABLE OF CONTENTS.

Page.

Aldrich, John Merton. The dipterous genus Symphoromyia in North America. No. 2099. July 16, 1915[1] 113–142

New species: *Symphoromyia barbata*, *S. inurbana*, *S. inquisitor*, *S. kincaidi*, *S. montana*, *S. pilosa*, *S. plumbea*, *S. sackeni*.

Alexander, Charles Paul. On a collection of Javanese crane-flies (Tipulidae, Diptera) in the United States National Museum. No. 2103. August 13, 1915[1] 157–193

New genus: *Rhampholimnobia*.
New species: *Dicranomyia albitarsis*, *D. atrescens*, *D. erythrina*, *D. excelsa*, *D. simplissima*, *D. carneotincta*, *Geranomyia linearis*, *G. javanica*, *Libnotes montivagans*, *L. nigricornis*, *Rhamphidia (Rhamphidia) apicalis*, *Rhampholimnobia reticularis*, *Antocha javanensis*, *Atarba javanica*, *Gonomyia (Gonomyia) bryanti*, *Mongoma saucia*, *Limnophila amica*, *L. palmeri*, *Ula javanica*, *Stibadocera metallica*, *Tipula umbrinoides*, *T. sunda*, *T. flavicosta*, *T. tjibodensis*, *T. salakensis*, *T. gedehicola*.
New subgenus: *Eurhamphidia*.
New subspecies: *Pachyrrhina immaculata pangerangensis*.

Banta, Arthur M., and Ross Aiken Gortner. An albino salamander, Spelerpes bilineatus. No. 2112. August 31, 1915[1] 377–379

Bartsch, Paul. The Philippine land shells of the genus Schistoloma. No. 2104. July 24, 1915[1] 195–204

New subgenus: *Hololoma*.
New subspecies: *Schistoloma (Schistoloma) alta mindoroensis*, *S. (S.) alta romblonensis*, *S. (S.) alta sibuyanensis*, *S. (S.) alta pygmaea*, *S. (S.) mcgregori tablasensis*, *S. (S.) mcgregori webbi*, *S. (Hololoma) quadrasi coronensis*.

——— The recent and fossil mollusks of the genus Rissoina from the west coast of America. No. 2094. July 24, 1915[1] 33–62

New species: *Rissoina excolpa*, *R. gisna*, *R. favilla*, *R. mazatlanica*, *R. helena*, *R. io*, *R. dina*, *R. peninsularis*, *R. adamsi*, *R. townsendi*, *R. barthelowi*, *R. lapazana*, *R. histia*, *R. burragei*, *R. nereina*, *R. pleistocena*, *R. californica*, *R. mexicana*, *R. cleo*, *R. cerrosensis*, *R. dalli*, *R. coronadensis*.
New name: *Rissoina signae*.

Page.

BELOTE, THEODORE T. Descriptive catalogue of the Washington relics in the United States National Museum. No. 2092. October 19, 1915[1] 1–24

BIGELOW, HENRY B. Eperetmus, a new genus of Trachomedusæ. No. 2114. August 31, 1915[1] 399–404

New genus: *Eperetmus.*
New species: *Eperetmus typus.*

CASANOWICZ, I. M. A colored drawing of the Medeba mosaic map of Palestine in the United States National Museum. No. 2111. August 23, 1915[1] 359–376

CAUDELL, A. N. Notes on some United States grasshoppers of the family Acrididae. No. 2093. June 12, 1915[1] ... 25–31

New genera: *Xeracris, Coniana, Heliaula, Aeoloplides.*
New species: *Coniana snowi.*
New variety: *Boopedon nubilum, var. maculata.*
New name: *Melanoplus mutatus.*

——— The genera of the Tettiginiid insects of the subfamily Rhaphidophorinae found in America north of Mexico. No. 2130. January 7, 1916[1] 655–690

New genera: *Rhachocnemis, Cnemotettix.*
New species: *Gammarotettix genitalis, Ceuthophilus genitalis, Pristoceuthophilus cercalis, Phrixocnemis longispinosus, P. obesus, P. oregonensis, Cnemotettix pulvillifer.*

COCKERELL, T. D. A. British fossil insects. No. 2119. December 11, 1915[1] 469–499

New genera: *Eospilopteron, Nematophlebia, Meshemipteron, Protocuneus, Phanerogramma, Philoponites, Schizoneurites, Paltostomopsis, Bibiodites, Protoberis, Stenomyites.*
New species: *Eospilopteron ornatum, Locustopsis lacoei, Haglopsis brodiei, Nematophlebia plicata, Meshemipteron incertum, Protocuneus punctatus, Elaterophanes acutus, Pseudotelephorus punctulatus, P. grandis, Holcoptera confluens, Glaphyroptula anglica, Philoponites clarus, Aneurhynchus conservatus, Ponera hypolitha, Dolichoderus britannicus, D. anglicus, D. ovigerus, Leptothorax gurnetensis, Oecophylla atavina, O. perdita, O. megarche, Necropsylla anglica, Psylla exhumata, Schizoneurites brevirostris, Culex protolepis, C. protorhinus, C. petrifactellus, Paltostomopsis ciliatus, Mycetophila vectensis, Sciara gurnetensis, S. lacoei, S. protoberidis, Tipula limiformis, Atarba vectensis, Bibiodites confluens, Psychoda primaeva, Protoberis obliteratus, Stratiomys brodiei, Ephydra oligocena, E. sepulta, Hippelates brodiei, Sphaerocera sepultula, Stenomyites fuscipennis, Megalestes anglicus.*

---

[1] Date of publication.

Page.

DALL, WILLIAM HEALEY. A review of some bivalve shells of the group Anatinacea from the west coast of America. No. 2116. November 27, 1915[1] ---------- 441–456

New species: *Thracia beringi, T. challisiana, T. diegensis, T. colpoica, Cyathodonta dubiosa, C. lucasana, C. pedroana, C. galapagana, C. cruziana, Kennerlyia granulata, K. convexa, K. patagonica, Coelodon radians, Foveadens panamensis, Lyonsia fretalis.*
New name: *Lyonsia gouldii.*

——— Notes on the species of the molluscan subgenus Nucella inhabiting the northwest coast of America and adjacent regions. No. 2124. December 11, 1915[1] ---------- 557–572

New varieties: *Thais lamellosa franciscana, T. l. hormica, T. l. neptunea, T. l. cymica, T. l. sitkana, T. canaliculata compressa, T. emarginata projecta.*

DODDS, G. S. Descriptions of two new species of Entomostraca from Colorado, with notes on other species. No. 2096. August 13, 1915[1] ---------- 97–102

New species: *Streptocephalus coloradensis, Diaptomus arapahoensis.*

EVANS, ARTHUR T. A collection of amphibians and reptiles from Gogebic County, Michigan. No. 2109. July 26, 1915[1] ---------- 351–354

GAHAN, A. B. A revision of the North American Ichneumon-flies of the subfamily Opiinae. No. 2095. August 23, 1915[1] ---------- 63–95

New genus: *Allobracon.*
New species: *Opius melleus, O. ferrugineus, O. flaviceps, O. vierecki, O. brunneitarsis, O. crassiceps, O. cincticornis, O. fuscipennis, O. canaliculatus, O. mandibularis, O. foersteri, O. coloradensis, O. rufocinctus, O. apicalis, O. ehrhorni, O. commodus, O. striativentris, O. gracillariae, O. americanus.*

GILMORE, CHARLES W. A new restoration of Stegosaurus. No. 2110. August 23, 1915[1] ---------- 355–357

——— On the fore limb of Allosaurus fragilis. No. 2120. November 27, 1915[1] ---------- 501–513

——— Osteology of Thescelosaurus, an orthopodous dinosaur from the Lance formation of Wyoming. No. 2127. December 23, 1915[1] ---------- 591–616

GORTNER, ROSS AIKEN. See Banta, Arthur M ---------- 377–379

---

[1] Date of publication.

Page.

Hansen, H. J. The Euphausiacean crustaceans of the "Albatross" Expedition to the Philippines. No 2129. January 14, 1916[1] ---------- 635–654

New species: *Euphausia fallax, Nematoscelis lobata.*

Hay, Oliver P. A contribution to the knowledge of the extinct Sirenian Desmostylus hesperus Marsh. No. 2113. August 31, 1915[1] ---------- 381–397

New family: Desmostylidæ.

Hinkley, Anson A. New fresh-water shells from the Ozark Mountains. No. 2126. December 23, 1915[1] ---------- 587–589

New species: *Anculosa arkansensis, Pyrgulopsis ozarkensis, Somatogyrus crassilabris.*

Hollister, N. The genera and subgenera of raccoons and their allies. No. 2100. August 13, 1915[1] ---------- 143–150

New genus: *Nasuella.*

Kennedy, Clarence Hamilton. Notes on the life history and ecology of the dragonflies (Odonata) of Washington and Oregon. No. 2107. July 28, 1915[1] ---------- 259–345

New species: *Argia emma.*

Malloch, J. R. Flies of the genus Agromyza, related to Agromyza virens. No. 2097. July 24, 1915[1] ---------- 103–108

New species: *Agromyza riparia, A. subvirens, A. gibsoni, A. eupatoriæ, A. coniceps.*

——— Notes on the flies of the genus Pseudodinia, with description of a new species. No. 2101. July 16, 1915[1] - 151–152

New species: *Pseudodinia polita.*

Marsh, C. Dwight. A new crustacean, Diaptomus virginiensis, and a description of Diaptomus tyrelli Poppe. No. 2117. December 11, 1915[1] ---------- 457–462

New species: *Diaptomus virginiensis.*

Marshall, William B. Three new species of Anodontites from Brazil. No. 2122. December 11, 1915[1] ---------- 527–529

New species: *Anodontites salmonea, A. darochai, A. aurora.*

Merrill, George P. Notes on the composition and structure of the Indarch, Russia, meteoric stone. No. 2098. July 24, 1915[1] ---------- 109–112

---

[1] Date of publication.

Page.

Merrill, George P. Report on some carbonic acid tests on the weathering of marbles and limestones. No. 2108. July 26, 1915[1] ---- 347–349

Oberholser, Harry C. A synopsis of the races of the crested tern, Thalasseus bergii (Lichtenstein). No. 2121. December 23, 1915[1] ---- 515–526

New subspecies: *Thalasseus bergii halodramus.*

——— Critical notes on the subspecies of the spotted owl, Strix occidentalis (Xantus). No. 2106. July 26, 1915[1] ---- 251–257

Pearse, A. S. An account of the crustacea collected by the Walker Expedition to Santa Marta, Colombia. No. 2123. December 23, 1915[1] ---- 531–556

New genus: *Minca.*
New species: *Cubaris brevispinis, Minca ruthveni, Sphaeroniscus gaigei, S. colombiensis, Ligyda richardsonae.*

Rohwer, S. A. Descriptions of new species of Hymenoptera. No. 2105. July 16, 1915[1] ---- 205–249

New genera: *Cimbicisoma, Xylocelia.*
New species: *Emphytina vanduzeei, Dimorphopteryx coloradensis, Tenthredella turneri, Pachyprotasis brunettii, Pontania amentivora, Pteronidea aceris, Lygaeonematus robinsonae, Croesus castaneae, Euura cosensii, Cimbicisoma dendrobii, Pezoporus (Schenkia) tenthredinarum, Lagarotis diprioni, L. virginianus, Homalomma caliroae, H. eriocampoides, H. pteronideae, Gnesia caliroae, Polyterus caliroae, Exenterus diprioni, Moerophora neoclyti, Amersibia prionoxysti, Scambus evetrivorus, Camposcopus aclerivora, Apanteles (Apanteles) sibinidis, A. (Protapanteles) phobetri, Gnamptodon nepticulae, Phanerotoma laspeyresia, Bassus coleophorae, Microbracon coleophorae, M. hemimenae, Trissomalus fulvicornis, Elis xanthonotus, Campsomeris (Campsomeris) pyrura, Ceropales neomexicana, Batazonus hookeri, B. mundiformis, Odynerus (Stenodynerus) blawus, O. (S.) odontoschius, O. (S.) anacardivora, O. margaretellus, Psen (Mimesa) modesta, Larropsis gracilis, L. dolosana, Pison aureosericeum, P. (Parapison) erythrogastrum, Nysson (Bathystegus) basirufus, Cerceris margaretella.*
New variety: *Odynerus (Stenodynerus) odontoschius*, var. *dichrous.*
New name: *Blennocampa assamensis.*

Snyder, John Otterbein. Notes on a collection of fishes made by Dr. Edgar A. Mearns from rivers tributary to the Gulf of California. No. 2125. December 23, 1915[1] ---- 573–586

New species: *Notropis mearnsi.*

---

[1] Date of publication.

TOWNSEND, CHARLES H. T. Diagnoses of new genera of Muscoid flies founded on old species. No. 2128. January 14, 1916[1] .... Page. 617–633

New genera: *Atelecephala*, *Microcalliphora*, *Euamphibolia*, *Microsenotainia*, *Parametopia*, *Nasonimyia*, *Patelloa*, *Eugaediopsis*, *Chaetogaediopsis*, *Eugaedia*, *Oedematocera*, *Phyllophorocera*, *Murdockiana*, *Pseudosiphona*, *Siphonopsis*, *Phylacteropoda*, *Nephopteropsis*, *Lophosiocera*, *Euthryptocera*, *Chaetostigmoptera*, *Slossonaemyia*, *Euchaetophleps*, *Urophyllopsis*, *Tortriciophaga*, *Phytoadmontia*, *Uromacquartia*, *Ictericophyto*, *Iconomedina*, *Pyraustomyia*, *Xanthophyto*, *Leskiopsis*, *Sipholeskia*, *Myobiopsis*, *Leskiopalpus*, *Parademoticus*, *Hinea*, *Peleteriopsis*, *Ocypteropsis*, *Ocypterodes*, *Neodionaea*, *Paradionaea*, *Neopsalida*, *Parapsalida*, *Odontosoma*, *Oedematopteryx*, *Trichoclytia*.

New species: *Peleteriopsis tegulata*.

——— New neotropical Muscoid flies. No. 2115. November 27, 1915[1] 405–440

New genera: *Paramyocera*, *Punaclista*, *Dolichamobia*, *Punasarcophaga*, *Punaphyto*, *Plagimasicera*, *Protogoniopsis*, *Echinomasicera*, *Belvosiomima*, *Calpodomyia*, *Neometachaeta*, *Pseudeuantha*, *Minthopsis*, *Neominthopsis*, *Epiphanocera*, *Rhombothyriops*, *Lachnommopsis*, *Hypochaetopsis*, *Chaetophlepsis*, *Micronychiops*, *Oestrogastropsis*, *Oestrogastrodes*, *Argyreomyia*, *Exoristopsis*, *Zygofrontina*, *Punamyia*, *Parepalpodes*, *Euepalpodes*, *Agicuphocera*, *Neoarchytas*, *Makasinocera*, *Anemorilla*, *Acemyiopsis*, *Oömeigenia*, *Chrysoexorista*, *Microplagia*, *Sphalloglandulus*, *Siphopsalida*, *Ectophasiopsis*.

New species: *Paramyocera discalis*, *Punaclista setosa*, *Dolichamobia auromaculata*, *Punasarcophaga auromaculata*, *Punaphyto tridens*, *Plagimasicera petiolata*, *Protogoniopsis arida*, *Echinomasicera hystrix*, *Belvosiomima fosteri*, *Calpodomyia linearis*, *Neometachaeta polita*, *Pseudeuantha linellii*, *Minthopsis vittata*, *Neominthopsis discalis*, *Epiphanocera costalis*, *Rhombothyriops elegans*, *Lachnommopsis armata*, *Hypochaetopsis chaetosa*, *Chaetophlepsis tarsalis*, *Micronychiops aurescens*, *Oestrogastropsis mexicana*, *Oestrogastrodes similis*, *Argyreomyia busckii*, *Exoristopsis setifera*, *Zygofrontina capitis*, *Punamyia transitionalis*, *Parepalpodes rimacensis*, *Euepalpodes arcuatus*. *Agicuphocera nigra*, *Neoarchytas inambarica*, *Makasinocera unguis*, *Anemorilla rufescens*, *Acemyiopsis punensis*, *Oömeigenia chosica*, *Chrysoexorista viridis*, *Microplagia nitens*, *Sphalloglandulus unicus*, *Siphopsalida meridionalis*, *Ectophasiopsis chilensis*.

WHERRY, EDGAR T. A peculiar oolite from Bethlehem, Pennsylvania. No. 2102. August 13, 1915[1] 153–156

——— Notes on Allophanite, Fuchsite, and Triphylite. No. 2118. November 27, 1915[1] 463–467

---

[1] Date of publication.

LIST OF ILLUSTRATIONS.

PLATES.

		Facing page.
1.	Plaster statue of Washington, by Ferdinand Pettrich	24
2.	Plaster statue of Washington, by William R. O'Donovan	24
3.	Plaster copy of Houdon's bust of Washington	24
4.	Miniature portraits of Gen. and Mrs. Washington	24
5.	Black-walnut chairs	24
6.	Mahogany armchairs	24
7.	Silver-plated wall-bracket lamps and brass candelabrum	24
8.	Silver-plated double lamp	24
9.	Silver-plated knives and forks	24
10.	Silver-plated tray, table coasters, saltcellars, and cake basket	24
11.	Silver-plated trays	24
12.	Wooden tea tray	24
13.	Cutlery case	24
14.	Canton-china platters	24
15.	Canton-china bowls and water bottle	24
16.	Chinese vases	24
17.	China bowl	24
18.	China and glassware	24
19.	Old English drinking glasses	24
20.	Continental Army uniform	24
21.	Roll and muster of Washington's Guard, 1782	24
22.	Camp mess chest and contents	24
23.	Surveyor's compass	24
24.	Field glass and case	24
25.	Portable writing case	24
26.	English keyed zither presented by Washington to "Nelly" Custis	24
27.	Furniture owned by Washington at Mount Vernon	24
28.	Recent and fossil West American *Rissoinas*	62
29.	Recent and fossil West American *Rissoinas*	62
30.	Recent and fossil West American *Rissoinas*	62
31.	Recent and fossil West American *Rissoinas*	62
32.	Recent and fossil West American *Rissoinas*	62
33.	Recent and fossil West American *Rissoinas*	62
34.	Details of Braconidae of the subfamily Opiinae	96
35.	Wings of the Braconidae of the subfamily Opiinae	96
36.	Details of *Agromyza* species, pupae, and imagines	108
37.	The Indarch, Russia, meteoric stone	112
38.	Skulls of *Nasuella* (1) and *Nasua* (2)	150
39.	Tooth rows of Procyonidae	150
40.	Cross sections of Oolite rock from Bethlehem, Pa	156
41.	Sections showing structural details in Oolite from Bethlehem, Pa	156
42.	Venation of Javanese crane flies	194
43.	Venation of Javanese crane flies	194
44.	Venation of Javanese crane flies	194
45.	Venation of Javanese crane flies	194

Facing page.
46. Venation of Javenese crane flies........ 194
47. Antennal and hypopygial structures of Javanese crane flies........ 194
48. Hypopygial structures of Javanese crane flies........ 194
49. Hypopygial structures of Javanese crane flies........ 194
50. Hypopygial structures of Javanese crane flies........ 194
51. Philippine land shells of the genus *Schistoloma*........ 204
52. Model of *Stegosaurus stenops* Marsh........ 358
53. The Medeba mosaic map of Palestine........ 376
54. Albino *Spelerpes bilineatus*........ 380
55. Normal *Spelerpes bilineatus*........ 380
56. Skull of *Desmostylus hesperus* Marsh........ 398
57. Skull of *Desmostylus hesperus* Marsh........ 398
58. Skull and teeth of *Desmostylus hesperus* Marsh........ 398
59. *Eperetmus*, a new genus of Trachomedusae........ 404
60. British fossil insects........ 500
61. British fossil insects........ 500
62. British fossil insects........ 500
63. British fossil insects........ 500
64. British fossil insects........ 500
65. British fossil insects........ 500
66. Ranges of the subspecies of *Thalasseus bergii*........ 526
67. *Anodontites salmonea*........ 530
68. *Anodontites darochai*........ 530
69. *Anodontites aurora*........ 530
70. *Pseudothelphusa pearsei*........ 556
71. *Pseudothelphusa clausa*........ 556
72. *Pseudothelphusa angulata*........ 556
73. *Pseudothelphusa ruthveni*........ 556
74. *Thais* (*Nucella*) *canaliculata* and *T.* (*N.*) *lamellosa*........ 572
75. *Thais* (*Nucella*) *emarginata* and *T.* (*N.*) *lima*........ 572
76. Osteology of fishes........ 586
77. Osteology of fishes........ 586
78. Fresh-water shells from the Ozark Mountains........ 590
79. Right side of the skeleton of *Thescelosaurus neglectus*........ 616
80. Restoration of the skeleton of *Thescelosaurus neglectus*........ 616
81. Restoration of *Thescelosaurus neglectus*........ 616
82. Restoration of the skeleton of *Hypsilophodon foxii*........ 616
83. Euphausiacean crustaceans from the Philippine Islands........ 654

TEXT FIGURES.

Page.
Streptocephalus coloradensis. Head of male........ 98
Streptocephalus coloradensis. Head of female........ 98
Diaptomus arapahoensis. Abdomen of female........ 99
Diaptomus arapahoensis. Last three segments of right antenna of male........ 100
Diaptomus arapahoensis. Fifth foot of female........ 100
Diaptomus arapahoensis. Fifth feet of female........ 101
Diaptomus lintoni. Last three segments of male right antenna, showing the two extremes of the appendage of the antepenultimate segment........ 101
Diaptomus lintoni. Terminal segments of male right antenna........ 101
Diaptomus shoshone. Female abdomen........ 102
Diaptomus leptopus, var. *piscinae.* Terminal segments of male right antenna.. 102
Agromyza coniceps. Head of male in profile........ 107

Page.
Head of *Symphoromyia cruenta.* 1, male; 2, female 123
Outline of front of head *Symphoromyia inquisitor*, female, to show width of front 128
Outer side of right antenna of *S. kincaidi* 130
Outer side of *S. pachyceras:* left antenna of male; and right antenna of female 134
Outer side of left antenna of *S. pilosa*, male 136
Head of *S. plagens*, male and female 137
Outer side of right middle coxa of *S. securifera* 141
Archilestes californica, male. 1. Dorsal view. 2. Lateral view 261
Archilestes californica, female. 3. Dorsal view. 4. Lateral view 262
Archilestes californica. 5–7 male appendages. 8. Male segment, ventral view. 9. Male segment showing chitinous framework. 10–11. Penis. 12. Female prothorax. 13. Female mesostigmal lamina. 14. Female abdominal segments. 15. *Archilestes grandis*, dorsal view of male appendages 263
Archilestes californica. 16. Ovipositing. 17. In copulation. 18. Scars from oviposition, one year old. 19. Scars two years old. 20. Bark cut away showing eggs in cambium. 21. Egg 264
Archilestes californica, nymph. 22. Lateral view. 23. Dorsal view. 24. Labium. 25. Abdominal segment. 26. Color of a live Palo Alto, California, specimen 265
Argia emma, male. 27. Dorsal view. 28. Lateral view 272
Argia emma, female. 29. Dorsal view. 30. Lateral view 273
Argia vivida, male. 31. Dorsal view. 32. Lateral view 274
Argia vivida, female. 33. Dorsal view. 34. Lateral view 275
Argia emma, nymph. 35. Lateral view. 36. Dorsal view 277
Argia vivida, nymph. 37. Lateral view. 38. Dorsal view 278
Argia emma, abdominal segments. 39. Lateral view. 40. Dorsal view. 41. Ventral view. *Argia funebris*, male abdominal segment, lateral view. 42. *Argia funebris*, male abdominal segment. 43. Lateral view. 44. Dorsal view. *Argia vivida*, male abdominal segments. 45. Lateral view. 46. Dorsal view. 47. Ventral view. 48. *Argia emma*, female, mesostigmal laminae. 49. *Argia vivida*, female, mosostigmal laminae 279
Argia emma, male abdominal segments. 50. Lateral view. 51. Ventral view. *Argia vivida*, male abdominal segments. 52. Lateral view. 53. Ventral view. 54. *Argia emma*, ovipositing 281
Argia emma. 55–57. Male, marking on head and thorax. 58–59. Male, marking on abdomen in tenerals, lateral view. 60–61. Female, marking on abdomen in tenerals, dorsal view. 62–64. *Argia vivida.* Male, marking on head and thorax 282
Argia emma, nymphal detail. 65. Labium, ventral view. 65*a*. Labium, dorsal view. 66–67. Vulva. 68–69. Abdominal segment of male. 70. Antenna. 71–76. *Argia vivida*, nymphal detail. 71. Labium, ventral view. 71*a*. Labium, dorsal view. 72–73. Vulva. 74–75. Abdominal segment of male. 76. Antenna 284
Ischnura cervula, male. 77. Dorsal view. 78. Lateral view 297
Ischnura cervula, female. 79. Dorsal view. 80. Lateral view 298
Ischnura perparva, male. 81. Dorsal view. 82. Lateral view 299
Ischnura perparva, teneral female. 83. Dorsal view. 84. Lateral view 300
Ischnura perparva, aged female. 85. Dorsal view. 86. Lateral view 301
Ischnura cervula. 87. In copulation. 88. Ovipositing. 89. Male clasping organs attached to female prothorax. 90. Copulation, detail. 91. Male, segment, parts in copulatory position. *Ischnura perparva.* 92. In copulation. 93. Ovipositing 302

Page.
Ischnura cervula. 94. Male, segment. 95. Male, segment dissected. 96. Male, segments, ventral view. 97. Male appendages. 98. Male prothorax. 99. Female prothorax. 100. Female mesostigmal lamina. *Ischnura perparva.* 101. Male, segment. 102. Male, segments, ventral view. 103. Male prothorax. 104. Male appendages. 105. Female mesostigmal lamina........ 303
Ischnura cervula. 106. Teneral female with light coloration. 107. Teneral female with dark coloration. 108. Female with very dark coloration which approaches male coloration. 109. Male coloration........................ 304
Ischnura perparva, female. 110–114. Variations in teneral coloration. 115. Stage intermediate between teneral and adult, showing formation of adult coloration on segments. 116. Adult coloration. *Ischnura cervula,* female. 117. Teneral female with light coloration. 118. Teneral female with dark coloration showing formation of adult coloration on eyes and femora. 119. Female, final or senile coloration.. 305
120–121. *Ischnura cervula,* nymph. 122. *Ischnura perparva,* nymph........ 306
Ischnura perparva, nymph. 123. Dorsal view of labium. 124–126. Mental seta of three reared nymphs. *Ischnura cervula,* nymph. 127. Dorsal view of labium. 128–130. Mental seta of three reared nymphs. 131. Male segment, ventral view. 132. Female segment, ventral view.................. 307
Macromia magnifica, male. 133. Dorsal view. 134. Lateral view............ 314
Macromia magnifica, female. 135. Dorsal view. 136. Lateral view.......... 316
Macromia magnifica. 137–138. Segment of male. 139–141. Segment and appendages of male. 142–144. Segments of female. 145. Front leg of male showing tibial keel.. 317
Macromia magnifica, nymph. 146. Dorsal view. 147. Lateral view with labium extended.. 318
Macromia magnifica, nymph. 148. Labium. 149. Abdomen. 150. Segments of abdomen, ventral view. 151. "Face." 152. Lateral view of head. 153. Antenna. *Macromia illinoiensis,* nymph. 154. Labium. 155. Abdomen. 156. Segments of abdomen, ventral view. 157. Lateral view of head. 158. Antenna.. 319
Macromia magnifica, copulation (159).. 320
Agrion aequabile yakima. 160–161. Wings of male and female showing extent of color. 162. Segment of male. 163. Penis. 164. Male appendages. 165–166. Nymph. 167. Dorsal view of labium of nymph.......................... 323
Lestes congener, nymph. 168. Lateral view. 169. Dorsal view. 170. Labium. 171. Head, lateral view. 172. Segments.......................... 324
Lestes uncatus, nymph. 173. Lateral view. 174. Dorsal view. 175. Labium. 176. Head.. 325
Coenagrion resolutum. 177. Male appendages. 178. Segment and penis. 179. Male prothorax. 180. Female prothorax showing the right dorsal "pit." 181. Mesostigmal lamina. 182–183. Male color patterns. 184. Female color pattern.. 326
Coenagrion resolutum, nymph. 185. Lateral view. 186. Dorsal view. 187. Detail of caudal gill. 188. Lateral fold of abdomen showing the spinulose edge. 189. Labium.. 327
Ophiogomphus severus, nymph. 190. Lateral view. 191. Dorsal view. 192. Segment. 193–194. Labium. *Ophiogomphus occidentis,* nymph. 195. Abdomen, dorsal view. 196. Segment. 197. Labium. *Gomphus* sp. 198. Dorsal view. 199. Head. 200. Labium. 201. Segments.................. 328
Dermal plates of *Stegosaurus stenops* Marsh.................................. 356
Diaptomus virginiensis. Lateral wing last cephalothoracic segment............ 457
Diaptomus virginiensis. Abdomen of female.................................. 457

Page.
Diaptomus virginiensis. Terminal segments of antenna of male................ 458
Diaptomus virginiensis. Fifth foot of female.................................. 458
Diaptomus virginiensis. Fifth foot of male.................................... 458
Diaptomus tyrelli. Terminal segments antenna of male from Yellowstone Park. 461
Diaptomus tyrelli. Terminal segments antenna of male from Alturas Lake, Idaho.. 461
Left fore limb of *Ceratosaurus* (*Allosaurus fragilis* of Marsh).................. 502
Right fore limb and foot of *Allosaurus fragilis* Marsh.......................... 504
Right humerus of *Allosaurus fragilis* Marsh..................................... 506
Left ulna of *Allosaurus fragilis* Marsh.. 507
Right radius of *Allosaurus fragilis* Marsh....................................... 507
Carpal bones of *Allosaurus fragilis* Marsh...................................... 508
Digits of the right fore foot of *Allosaurus fragilis* Marsh...................... 509
Map of the region about Santa Marta, Colombia.................................. 533
Diagram to show the crustaceans in various habitats in Colombia and their migration routes.. 538
Philoscia culebrae. Left uropod and telson..................................... 541
Philoscia walkeri. *a*, antenna; *t*, telson; *u*, uropod........................ 542
Cubaris brevispinis. *a*, antenna; *e*, ventral surface of first two epimera; *h*, head; *t*, telson; *u*, uropod.. 543
Minca ruthveni. *a*, first antenna; a^2, second antenna; *e*, ventral surface of first three epimera; m^1, first maxilla; m^2, second maxilla; *mp*, maxilliped; *t*, telson; *u*, uropod.. 545
Sphaeroniscus gaigei. *a*, antenna; m^1, first maxilla; m^2, second maxilla; *mp*, maxilliped; *u*, uropod.. 547
Sphaeroniscus colombiensis. *a*, antenna; *h*, head and first thoracic segment; m^1, first maxilla; m^2, second maxilla; *mp*, maxilliped; *u*, uropod.................. 548
Ligyda richardsonae. *a*, antenna; *c*, copulatory organ; *l*, first leg of male; *m*, first maxilla; *mp*, maxilliped... 549
Notropis mearnsi... 583
Cervical vertebra of *Thescelosaurus neglectus*.................................. 592
Cervical vertebra of *Thescelosaurus neglectus*. Ventral view..................... 593
Fifteenth presacral vertebra, probably the second dorsal of *Thescelosaurus neglectus*. Lateral view.. 593
Eighth presacral vertebra of *Thescelosaurus neglectus*. Lateral view............ 594
Third presacral vertebra of *Thescelosaurus neglectus*. Lateral view............. 594
Anterior caudal vertebrae of *Thescelosaurus neglectus*.......................... 595
Median caudal vertebrae of *Thescelosaurus neglectus*............................ 596
Distal caudal vertebrae of *Thescelosaurus neglectus*............................ 596
Left scapula of *Thescelosaurus neglectus*....................................... 597
Left scapula and coracoid of *Thescelosaurus neglectus*.......................... 598
Left fore limb of *Thescelosaurus neglectus*...................................... 600
Right femur of *Thescelosaurus neglectus*.. 602
Left tibia of *Thescelosaurus neglectus*.. 603
Right hind leg of *Thescelosaurus neglectus*...................................... 604
Right hind foot of *Thescelosaurus neglectus*..................................... 605
Metatarsals of right hind foot of *Thescelosaurus neglectus*...................... 606
Pelvis and sacrum of *Thescelosaurus neglectus*.................................. 607
Right thoracic rib of *Thescelosaurus neglectus*.................................. 609
Fragment of sternal bone and sternal ribs of *Thescelosaurus neglectus*.......... 610
Map showing localities where *Thescelosaurus* remains have been found. (1) Niobrara County, Wyoming; (2) Deer Ears Buttes, South Dakota; (3) Hell Creek, in Montana.. 613

Page.
Figure showing the dorsal spurs, apical calcars, and ventral spines of a typical hind tibia........ 656
Tripidischia xanthostoma. Cross section of hind tibia........ 658
Diestrammena marmorata. Hind tibia and tarsus, outer side........ 660
Gammarotettix bilobatus. Last dorsal segment of the abdomen and the cerci of the male........ 663
Gammarotettix bilobatus. Subgenital plate of the female........ 663
Gammarotettix bilobatus. Hind tarsus........ 663
Gammarotettix genitalis. Last dorsal segment of the abdomen and the cerci of the male type........ 663
Gammarotettix genitalis. Subgenital plate of the female type........ 664
Ceuthophilus nodulosus. Hind leg of male type........ 667
Ceuthophilus nodulosus. End of the abdomen of the male type........ 668
Pristoceuthophilus celatus. Head, showing the vertical horn........ 671
Pristoceuthophilus celatus. Hind leg of adult male........ 672
Pristoceuthophilus celatus. Cercus of adult male........ 672
Pristoceuthophilus celatus. Cercus of immature male type........ 672
Pristoceuthophilus tuberculatus. Dorsum of abdomen of adult male type........ 673
Pristoceuthophilus tuberculatus. Hind leg of male type........ 673
Pristoceuthophilus cercalis. Cerci of adult male type........ 674
Pristoceuthophilus marmoratus. Hind leg........ 675
Pristoceuthophilus pacificus. Hind leg of male type........ 676
Pristoceuthophilus pacificus. Hind leg of male in the Scudder collection........ 676
Phrixocnemis longispinosus. Adult female........ 678
Phrixocnemis truculentus. Hind leg of male type........ 680
Phrixocnemis neomexicanus. Hind tibia and tarsus of male type, inner side........ 683
Rhachocnemis hostiferus. Hind tibia and tarsus of female type, inner side........ 684
Daihinia brevipes. Hind tibia and tarsus of female, inner side........ 685
Daihinia phrixocnemoides. Female type........ 686
Hemiudeopsylla californiana. Adult female type........ 689
Hemiudeopsylla platyceps. Hind tibia and tarsus of male type........ 689

DESCRIPTIVE CATALOGUE OF THE WASHINGTON RELICS IN THE UNITED STATES NATIONAL MUSEUM.

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INTRODUCTION.

The collection of objects in the United States National Museum relating to George Washington consists of a variety of material gathered from numerous sources. While composed largely of articles of domestic and artistic interest, which were owned by Washington at Mount Vernon, the collection includes also mementos of his life in the field during the War of the Revolution, and a number of other miscellaneous relics of greater or less importance.

Mount Vernon house,[1] historically the most interesting of American mansions, and closely associated with nearly all the objects herein described, was erected in 1743 for Lawrence Washington, the half-brother of George, and so named in honor of Admiral Edward Vernon, R. N., under whose command Lawrence Washington had served during the British expedition against Cartagena in 1741. The property [2] passed into the hands of George after the death of Lawrence in 1752, and the house was later improved and enlarged. When Mrs. Washington died in 1802 Mount Vernon became, in accordance with Washington's will, the property of his nephew Bushrod Washington, who in turn bequeathed it to his nephew John Augustine

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[1] Benson J. Lossing, in his work Mount Vernon and Its Associations, Hartford, 1870, has given an interesting popular account of the history of Mount Vernon and of the objects which the mansion contained during the lifetime of Washington. While the historical accuracy of some of Mr. Lossing's statements has been questioned, the work gives much information of value not elsewhere available.

[2] The original tract of land consisted of five thousand acres above Dogue Run which, in 1674, was granted by Governor Berkeley jointly to John Washington, great-grandfather of George and Lawrence Washington, and to Nicholas Spencer, of Bedford, England. John Washington's half lay between Dogue Run and Little Hunting Creek. By his will, dated September 11, 1675, he bequeathed this Hunting Creek property to his son Lawrence Washington, grandfather of George, who in turn bequeathed it in 1697, to his daughter Mildred, from whom it was inherited in 1730 by Augustine Washington, father of George. In 1740 Augustine Washington conveyed the tract to his son Lawrence, and in 1743 confirmed the gift by will, providing, however, that should Lawrence die without issue the property should go to Lawrence's half-brother George. Lawrence died in 1752, leaving a widow and daughter. The daughter dying soon after, the estate passed to George Washington, but the widow of Lawrence retained a life interest in it, which interest she released to George Washington in 1754 in consideration of fifteen thousand pounds of tobacco to be given her annually during her natural life. She died in 1761. See George Washington and Mount Vernon, by Moncure Daniel Conway. Memoirs of the Long Island Historical Society, vol. 4, Brooklyn, N. Y., 1889.

Washington, from whom it passed to a son of the same name, and in 1858 was purchased from him by the Mount Vernon Ladies' Association.[1]

By an act of Congress approved June 20, 1878,[2] the Government purchased a collection of Washington relics from G. W. Lewis and others, the heirs of Mrs. Lawrence Lewis,[3] the adopted daughter of Washington and the wife of his nephew Major Lawrence Lewis. After the death of Mrs. Washington in 1802 these objects had passed into the hands of Mrs. Lewis, and on her death in 1852 were received by her heirs, who held them until their purchase by the Government in 1878, when they were deposited in the United States Patent Office, where they remained until transferred to the United States National Museum in 1883.

The objects purchased from the Lewis heirs form the greater portion of the Washingtoniana in the Museum, and are designated as belonging to the "Lewis collection" in the present catalogue. The sources of other Washington relics, received by the Museum at various times as loans or gifts, are given in connection with the description of the articles.

In the Museum collection of Washingtoniana, manuscripts are lacking. The science of history, however, is not confined to manuscripts alone for the sources of its data, and the collection as it stands is of great interest and value, both to the student of history and to the general public.

In the preparation of this catalogue a number of works on antiques have been consulted and references to these are given in footnotes. Besides the printed authorities referred to in the footnotes, the information herein given has been derived from labels accompanying the objects while in the Patent Office,[4] and from the correspondence of the Museum authorities with the Patent Office authorities and with individuals who have had more or less personal knowledge of the various objects in the collection. Information concerning the collection, not otherwise attributed in the footnotes, has been derived from these manuscript sources now in the Museum files.

Acknowledgment should be made of the important assistance rendered in the preparation of this catalogue by Mr. A. Howard Clark, curator of the Division of History of the United States National Museum, under whose supervision the Washington collection was removed from the Patent Office to its present location in 1883.

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[1] See Mount Vernon and its Preservation, 1858-1910, by Thomas Nelson Page, New York, 1910.

[2] See U. S. Statutes at Large, vol. 20, p. 218.

[3] Eleanor Parke Custis (Nelly Custis), the granddaughter of Mrs. Washington, married Lawrence Lewis, son of Fielding Lewis and "Betty" Washington, sister of General Washington. See Appendix 1 of this paper.

[4] Alfred Hunter, in his work, A popular catalogue of the extraordinary curiosities in the National Institute, arranged in the building belonging to the Patent Office, Washington, 1858, refers briefly to the Washington collection then in the Patent Office.

STATUES, PAINTINGS, AND ENGRAVINGS.

Plaster statue of Washington.[1]—Life size figure in military uniform, representing Washington before Congress, resigning his commission as Commander in Chief of the Continental Army, Annapolis, Maryland, December 23, 1783. Designed by Ferdinand Pettrich and presented to the National Institute by the sculptor in 1842. Transferred from the U. S. Patent Office to the U. S. National Museum in 1883. Plate 1. Cat. No. 92679, U.S.N.M.

Plaster statue of Washington.—Life size figure in military uniform, designed by William Rudolph O'Donovan, being the original model of the bronze statue ordered by the State of New York for Washington's headquarters at Newburgh, New York, in 1886. From Maurice J. Powers. Plate 2. Cat. No. 125786, U.S.N.M.

Plaster bust of Washington.—Copy, made by Clark Mills in 1853, from the original life cast made by Houdon at Mount Vernon in 1785. Gift of Miss Elizabeth Bryant Johnston. Height, 19 inches; base, 7¾ by 10¼ inches. Plate 3. Cat. No. 218154, U.S.N.M.

Bronze bust of Washington.—Copy of the bust made by Houdon at Mount Vernon in 1785. Cast at the National Fine Art Foundry, New York. Height, 24 inches; base, 7¾ inches square. From Maurice J. Powers. Cat. No. 202333, U.S.N.M.

Plaster face mask of Washington.—Cast from the mold made at Mount Vernon by Houdon in 1785. Height, 9½ inches; width, 7½ inches. Lent by the National Society of the Daughters of the American Revolution. Cat. No. 3962, U.S.N.M.

Portrait of Washington.[2]—Oil painting, artist unknown. Half length, life size, and by the Lewis family regarded as a very excellent likeness. Retained at the Patent Office when the Lewis collection was transferred to the United States National Museum in 1883, and transferred to the Smithsonian Institution from the Department of the Interior in 1911. Size, 30 by 44 inches. Lewis collection. Cat. No. 276149, U.S.N.M.

Miniature portrait of Washington.—By John Trumbull. Oil on wood in the original frame of wood, which is carved and gilded. Three-quarter face to the right, and bust, in civilian dress of the period with dark coat and white neckerchief. Made from life during the period from 1792 to 1794, when Trumbull was engaged in painting his full-length portrait of Washington at the President's House in Philadelphia. Size, 6 by 7 inches. Lewis collection. Plate 4. Cat. No. 92356, U.S.N.M.

Miniature portrait of Martha Washington.—By John Trumbull. Oil on wood in the original frame of wood, which is carved and gilded.

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[1] In connection with this statue and other objects of art mentioned in this list, see The National Gallery of Art, by Richard Rathbun, Washington, 1909. Bulletin 70, U. S. National Museum.

[2] See Annual Report of the Smithsonian Institution for 1911, p. 105.

Full face and bust, in dress of the period, of light material, with shawl about shoulders and white lace cap with blue ribbon. Painted from life during the period from 1792 to 1794. Size, 6 by 7 inches. Lewis collection. Plate 4. Cat. No. 92357, U.S.N.M.

Oil painting.—Supposed to represent Genesee Falls, New York. From Mount Vernon. Size, 39 by 49½ inches. Lewis collection. Cat. No. 92220, U.S.N.M.

Oil painting.—Moonlight scene on a rocky coast. From Mount Vernon. Size, 31 by 43½ inches. Lewis collection. Cat. No. 92221, U.S.N.M.

Engraved portrait of the Right Honorable Selina, Dowager Countess of Huntingdon.—By "J. Fittler, engraver to His Majesty." From a painting by R. Bowyer, "Miniature painter to His Majesty." The countess is shown seated at a table, her left arm resting on a large volume. Presented to Washington by the countess. Size, 10½ by 8½ inches. Lewis collection. Cat. No. 92405, U.S.N.M.

Portrait of Martha Washington.—Colored print, published about 1790 by J. Testi, 10 Leather Lane, Holborn, London. Mrs. Washington is shown attired in an evening gown of the period and seated upon a chair under a crimson canopy. She wears a pearl necklace and a diadem. The legend reads: "Lady Washington." Gift of C. R. Whedon. Size, 7¾ by 5¾ inches. Cat. No. 122189, U.S.N.M.

Portrait of Washington.—Colored print, published about 1790 by J. Testi, 10 Leather Lane, Holborn, London. Washington is shown in military uniform seated upon a chair under a canopy. The legend reads: "General Washington." Gift of C. R. Whedon. Size, 7¾ by 5¾ inches. Cat. No. 122190, U.S.N.M.

FURNITURE.

Washington's easy chair.—Plain heavy solid wing-cheek frame of Hepplewhite design with curved arms extending from front to top of back.[1] Upholstered in linen with hair cushions. Original cover lacking. Re-covered about 1850 with chintz cloth of striped design. From the bedroom of Washington at Mount Vernon, and used by him a short time before his death. Height, 48 inches; width, 31 inches; depth, 22 inches. Lewis collection. Plate 27. Cat. No. 92216, U.S.N.M.

Twelve black walnut chairs.—Backs open and straight, Sheraton style, the splats carved in the shape of a lyre. Legs square and straight. Seats upholstered with blue and drab cloth of a delicate floral pattern with circular designs in center. Height, 36 inches; width, 20½ inches; depth, 17½ inches. Lewis collection. Plate 5. Cat. No. 92201–12, U.S.N.M..

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[1] Compare N. Hudson Moore, The Collector's Manual, New York, 1906, p. 56.

Mahogany footstool.—Original cover lacking. Re-covered about 1850 with large figured red, blue, green and brown Brussels carpet. Used in Washington's bedroom at Mount Vernon. Length, 17 inches; width, 13 inches; height, 8½ inches. Lewis collection. Cat. No. 92213, U.S.N.M.

Two mahogany armchairs.—Open backs, Hepplewhite style, the splats carved in shape of a shield with four vertical curved bars. Arms curved outward and downward. Front legs straight, back legs curved inward. Upholstered with black horsehair cloth. Part of the furniture of the President's house in Philadelphia, during Washington's second administration, 1793–1797. Height, 40 inches; width, 28 inches; depth, 19 inches. Lewis collection. Plate 6. Cat. No. 92214–15, U.S.N.M.

Two cherry crickets.[1]—Legs mortised through the tops and braced with small blocks. Sides braced with curved brackets. Length, 16¾ inches; width, 12¾ inches; height, 11½ inches. Lewis collection. Cat. No. 92217–18, U.S.N.M.

Mahogany table with marble top.—Frame plain. Legs curved outward, terminating in globular feet. Top of encrinal gray limestone, with reddish-brown and white tracings. Length, 44 inches; height, 30 inches; width, 26 inches. Lewis collection. Plate 27. Cat. No. 92402, U.S.N.M.

Mahogany table.—Sides and legs elaborately carved with conventional floral and geometrical designs. Top inclosed by a narrow strip rising an inch and a quarter above the sides. Used at Mount Vernon as a stand for ornaments and in serving tea. Height, 27 inches; width, 23 inches; length, 32 inches. Lewis collection. Cat. No. 92640, U.S.N.M.

Parlor mirror.—A central rectangular glass is surrounded by four narrow sections of glass separated from the central piece by gilded beadwork. The whole is inclosed by a broad carved gilt frame, surmounted by a small rectangular section of glass inclosed by a plain gilded bead. Above this rises an ornate slender crest of carved wood in the shape of a vase with an ornamental scroll of gilt wire arranged at either side extending down half the length of the mirror. Size, 43½ by 30¼ inches. Lewis collection. Plate 27. Cat. No. 92219, U.S.N.M.

Large parlor mirror.—The glass is divided into two sections, not separated by beadwork, and the whole is inclosed by a broad plain gilt frame. A narrow oak frame has been added for the sake of protection. Size, 82 by 43 inches. Lewis collection. Cat. No. 92224, U.S.N.M.

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[1] All objects not otherwise indicated were used by Washington at Mount Vernon. The Museum collections include a wooden model of this mansion showing its interior arrangement and the additions made at various times to the original house erected for Lawrence Washington in 1743. Length, 60 inches; width, 24 inches; heighth, 24 inches. Lent by Mr. H. H. Dodge. Cat. No. 255208, U.S.N.M.

Toilet mirror.—The glass is in two rectangular sections, upper and lower, the whole inclosed in a narrow frame of black walnut surrounded with a thin strip of maple. The glass of the upper section is decorated in gilt with a lacquered design of roses and leaves arranged in festoons with bows of ribbon. Presented by General Washington to Mrs. Washington in 1795. Size, 20 by 18 inches. Upper section 20 by 5 inches. Lewis collection. Cat. No. 92225, U.S.N.M.

Mahogany bedstead—consisting of the following pieces: Two plain square foot posts; two ornately-carved head posts, lower part of each square, and upper part fashioned after Greek columns; plain headboard with curved top; plain footboard with straight top; two plain side boards; thirteen plain pine slats; four plain pine slats for curtain supports. Presented by Admiral Edward Vernon, Royal Navy, to Lawrence Washington, who had served as captain in the expedition undertaken by Admiral Vernon against Cartagena in 1741.[1] Bequeathed to Washington by his half-brother, Lawrence, in 1752. Height, 6 feet 6 inches; width, 4 feet 8 inches; length, 6 feet 4 inches. Lewis collection. Cat. No. 92411–22, U.S.N.M.

Fire bellows.—Oval in shape with cone-shaped spout of iron. Sides and handles of ash wood, the former carved with a succession of concentric rings. Body of heavy brown leather, fastened to sides with iron tacks. Length, 27 inches; width, 11 inches. Lewis collection. Cat. No. 92534, U.S.N.M.

CANDELABRA, LAMPS, AND CANDLESTICKS.

Pair of glass candelabra.—Description of each as follows: Base pyramidal in shape and surmounted by a circular silver top above which rises a slender triangular stem of glass, surmounted by a circular dish-like top with scalloped edges upon which rests a cup-shaped ornament. From the silver top of the base extend four six-sided glass arms nearly at right angles to each other. Two of these extend upward, outward, and downward, and two extend outward, downward, and upward in the form of an "S," and support on each end cylindrical-shaped candle sockets, at the upper and lower ends of which are star-shaped ornaments projecting beyond the socket and from which hang glass pendants. The four arms are united by a gracefully festooned chain of glass pendants joined with metal links. The glass is of unusual clearness and the numerous pendants give a beautiful prismatic effect to the pieces. Height, 23 inches; width, 14 inches; base, 4¼ inches square. Lent by Miss Mary Custis Lee. Cat. No. 2088, U.S.N.M.

Pair of silver-plated wall-bracket lamps.—Each lamp consists of a circular bracket fitted with a horizontal arm which extends outward and supports an octagonal urn-shaped receptacle for oil. From the bottom of this urn extends horizontally a tube supporting on the end a cylindrical wick holder fitted with a small blue glass chimney. The wick is adjusted to the required height by means of a small rack screw on the side of the holder. The piece is plain with the exception of the receptacle for oil which is decorated at the top with a narrow band of floral design below which are engraved broad festoons of flowers. Height, 12½ inches; width, 8¾ inches. Lewis collection. Plate 7. Cat. No. 92244–45, U.S.N.M.

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[1] See Introduction to this paper, p. 1.

Silver-plated double lamp.—The base is of glass, pyramidal in shape and supports at the top an urn-shaped receptacle for oil. To the right and left of the urn extends a silver-plated tube supporting cylindrical holders for wicks and blue glass chimneys. Height, 14¼ inches; width, 12½ inches; base, 4 inches square. Lewis collection. Plate 8. Cat. No. 92243, U.S.N.M.

Silver-plated candlestick.—The base is octagonal, four of the sides being straight and four concave. The short stem rises above the base like an inverted bell. Used in one of the bedrooms at Mount Vernon. Base, 6¾ by 4¾ inches; height of stem, 4¼ inches. Lewis collection. Cat. No. 92410, U.S.N.M.

Brass candelabrum with reflector.—A heavy circular base supports a slender steel rod 21 inches high terminating in a brass ring. At right angles to the rod is a movable standard, bearing at either end a candlestick with circular base and cylindrical socket, and adjustable to the desired height by means of a screw attachment. The candlesticks, by means of the short arms joining them to the standard, may be swung to the front, side, or back. Behind the rod rises a brass standard curving outward and supporting a rectangular polished brass reflector adjustable to the desired height by means of a screw attachment. Used by Washington during the War of the Revolution, in the President's house in Philadelphia, and at Mount Vernon. Height, 22 inches; width, 15 inches; diameter of base, 5¾ inches. Reflector, 11½ inches by 6¾ inches. Lewis collection. Plate 7. Cat. No. 92255, U.S.N.M.

Pair of silver-plated candlesticks.—Description of each as follows: The circular base is decorated with two lines of beadwork and one of oak leaves. The stem, which rises above the base like a slender inverted cone, is decorated with a set design of geometrical character. Immediately below the socket, which is decorated with beadwork and oak leaves, is a design of drapery, gracefully festooned about the stem. Height, 10½ inches; diameter of base, 5¼ inches. Lewis collection. Cat. No. 92247, U.S.N.M.

Hall lantern.—A rectangular iron frame set with glass sides and bottom. The four corner strips of the frame curve over and unite in the center at the top to form an iron ball fitted with a ring for suspending the lantern from the ceiling. The bottom and sides are ornamented with slender open-work strips of iron. Dimensions 12 by 12 by 18 inches. Lent by Miss Mary Custis Lee.[1] Cat. No. 2089, U. S. N. M.

TABLE FURNISHINGS.[2]

Nine silver-plated knives and forks.—Four knives, the blades with elongated V-shaped backs and slender points slightly curved upward; handles plain with knob-shaped ends; length, 10 inches. Five three-tined forks with handles of same type as the knives described above. The handles of each of the knives and forks are engraved with the Washington crest, a raven issuing from a coronet. Marks indistinguishable Length, 8⅛ inches. Lewis collection. Plate 9. Cat. No. 92342–50, U.S.N.M.

Six salt cellars and stands.—Salt cellars of dark-blue Bohemian glass, an eight-pointed star design on bottom of each. Stands of silver plate oval in shape and ornately decorated in openwork, with festoons of lines and beadwork upheld by shields on either side and at the ends. Length, 3⅛ inches; height, 2 inches; width, 2⅜ inches. Lewis collection. Plate 10. Cat. No. 92249, U.S.N.M.

Silver-plated cake basket.—Oval in shape. Base an upright band of plate decorated with two lines of beadwork and an openwork design of a succession of tiny rectangles. Sides decorated with an ornate floral design in openwork and with rows of beadwork. Handle of heavy plate ornamented with openwork at the top and hinged at either end to side of basket. Length, 14½ inches; width, 10¼ inches; height, 3½ inches. Lewis collection. Plate 10. Cat. No. 92341, U.S.N.M.

Two silver-plated trays.—Circular in shape, with shallow sides. Decorated with the Washington coat of arms[3] and two lines of beadwork. Diameter, 10 inches. Lewis collection. Plate 11. Cat. No. 92339–40, U.S.N.M.

Silver-plated tray.—Oval in shape, with the sides decorated in openwork, with a succession of minature archways. At either end the sides are narrowed, rounded, and slightly raised above the base to serve as handles. Length, 20 inches; width, 15 inches; height, 1¼ inches. Lewis collection. Plate 10. Cat. No. 92338, U.S.N.M.

Three table coasters or stands for wine bottles.—The circular base of each is of oak wood, surrounded and slightly surmounted by a heavy band of openwork silver plate. The bottoms are covered with green baize. Diameter, 5 inches; height, 1¼ inches. Lewis collection. Plate 10. Cat. No. 92335–37.

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[1] Since the above was written this object has been withdrawn from the Museum by the owner.

[2] Unless otherwise described, the pieces of silverware and chinaware listed are without marks.

[3] A silver shield, divided horizontally by two crimson bars into five alternate white and crimson stripes, the first of which bears three crimson stars. The similarity of this design in certain points to that of the United States flag has often been noted by writer on the history of the latter subject.

Wooden tea tray.—Oval in shape; rosewood bottom covered underneath with green baize, the upper side decorated with a large oval floral design in inlaid woods, the whole surrounded by a wreath of rosebuds intertwined. A narrow raised rim of maple with a scalloped edge encircles the tray, which is fitted at either end with a bronze handle. Presented to the National Institute by F. P. Butler and transferred from the United States Patent Office in 1883 to the United States National Museum. Width, 24 inches; length, 32 inches; handles, 3¼ by 1½ inches; height of side, ⅝ of an inch. Plate 12. Cat. No. 92525, U.S.N.M.

Cutlery case.—Oak box with convex front and hinged lid, the whole covered with shagreen. Tiers of 48 small compartments, lined with green velvet, for knives and forks, rise one above the other from front to rear of the case, which is fitted with a lock and two small iron handles, one on either side near the front. Base, 9 by 9½ inches; height in front, 7½ inches; height in rear, 13½ inches. Lewis collection. Plate 13. Cat. No. 92400, U.S.N.M.

Silver wine cooler.[1]—Owned by Washington and presented by him to Oliver Wolcott, Secretary of the United States Treasury, 1795–1800. This piece of tableware, one of a number of the same type imported by Washington from France, is of an elliptical urn shape and is decorated on either side at the top with a lion's head, from which depends a small silver handle. Engraved on the front: "Presented by George Washington to Oliver Wolcott, Secretary of the Treasury." Length, 11 inches; width, 6½ inches; height, 8 inches. Lent by Miss Emily Tuckerman. Cat. No. 283159, U.S.N.M.

CHINAWARE.

Nine pieces of blue and white china.—Decorated with scenes of Oriental design and commonly known as old blue Canton ware. Used at Mount Vernon on ordinary occasions.

(*1*) *Octagonal platter*, with scalloped corners. Decorated with a scene showing two deer and a clump of trees in the foreground and a house and trees in the background. The picture, which is surrounded by a single narrow line, is lacking in detail. The rim of the platter is decorated with a narrow set design of butterfly wings, plants, and diaper work. Length, 17 inches; width, 13¼ inches; Lewis collection. Cat. No. 92226, U.S.N.M.

(*2*) *Octagonal platter*, with scalloped corners. Decorated with a scene showing in the foreground a promontory with a house, rocks, and trees and in the background on the right an island with a pagoda and trees. The rim bears a design of floral and diaper work. Length, 16½ inches; width, 12½ inches. Lewis collection. Cat. No. 92227.

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[1] See Lossing's Mount Vernon and Its Associations, pp. 263–265.

(3) *Octagonal platter*, with scalloped corners. Decorated with a land and water scene showing houses, a pagoda, trees, a bridge, boats, and a flock of birds in the background. The rim bears a heavy border of diaper work encircled with a floral design. Length, 16½ inches; width, 13¼ inches. Lewis collection. Plate 14. Cat. No. 92229, U.S.N.M.

(4) *Octagonal platter* with scalloped corners. Decorated with a land and water scene showing in the foreground on the right a house and garden surrounded by a wall, the whole connected by a bridge with a promontory on the left. In the background is an island with trees and houses. On the water are three boats and in the air a flock of birds. The rim bears a design of butterflies and diaper work. Length, 16 inches; width, 12½ inches. Lewis collection. Plate 14. Cat. No. 92230, U.S.N.M.

(5) *Circular platter.*—Decorated with a landscape scene showing a large willow tree with shrubbery to the right and left. About the rim is a complicated design of butterflies and flowers mingled with diaper work. Diameter, 15 inches. Lewis collection. Cat. No. 92228, U.S.N.M.

(6) *Washbowl.*—The interior is decorated with a scene at the mouth of a river showing on the right in the foreground a large house in a clump of trees. On the left in the background is a house on a promontory among trees. On the river appears a boat and in the air two birds. The interior near the rim bears also a band of diaper design. The rim flares outward and bears on the top a narrow band of beadwork. The exterior is decorated with three floral designs. Height, 4¼ inches; diameter, 11½ inches. Lewis collection. Plate 15. Cat. No. 92231, U.S.N.M.

(7) *Guglet or water bottle.*—Decorated with a scene on the banks of a river, showing houses and trees. Two birds appear in the air and on the river a boat with a man at the stern. A broad band of diaper pattern encircles the stem. Diameter of base, 3 inches; diameter of mouth, 1⅝ inches; diameter of body, 5¼ inches; height, 9¾ inches. Lewis collection. Plate 18. Cat. No. 92390, U.S.N.M.

(8) *Punch bowl.*—The interior is plain with the exception of a band of floral design near the rim broken by four heart-shaped medallions equally distant apart. One-half of the exterior is covered with large floral designs. The opposite side bears a single flower with two leaves. Height, 5 inches; diameter, 11¼ inches. Lewis collection. Plate 15. Cat. No. 92232, U.S.N.M.

(9) *Chinese vase.*—Decorated with a scene on the banks of a river and with a cloud-like design on the stem. Diameter of base, 1½ inches; diameter of mouth, ⅞ inch; diameter of body, 3¼ inches; height, 6¾ inches. Lewis collection. Plate 18, Cat. No. 92391, U.S.N.M.

Three Chinese vases.—Decorated in blue and gold with Chinese landscapes and water views. A narrow band of diaper pattern encircles the top and bottom of each. The lids are surmounted with the figure of a dog with mane and claws.[1] The dimensions of each vase are as follows: Diameter of bottom, 3½ inches; diameter of mouth, 1¾ inches; diameter of top, 3½ inches; height, 10⅛ inches. Lewis collection. Plate 16. Cat. No. 92386–92388, U.S.N.M.

Chinese vase.—Decorated in blue and gold with Chinese landscapes and water views. A narrow band of diaper pattern encircles the top and bottom. Mouth flares outward. Diameter of base, 3¼ inches; diameter of mouth, 5⅜ inches; height, 10⅛ inches. Lewis collection. Cat. No. 92389, U.S.N.M.[2]

Porcelain saucer.—Interior decorated with colored drawing of four Chinese figures, two men and two women. One of the men leans against a horse and is dressed in armor, the other carries a sword. One woman is seated, the other stands by the side of a vase. The interior of the rim bears a gilt band of geometrical and scroll design. Diameter, 8¼ inches; height, 1¼ inches. Lewis collection. Cat. No. 92353, U.S.N.M.

China bowl.—Interior without decoration. A narrow band of gilt encircles the exterior at top and bottom. The outside of the rim is decorated with a succession of wreaths of red roses and green leaves intertwined. Above the intersections of the wreaths are small dark-blue triangular designs with concave sides. The side of the bowl bears the monogram "G. W." in gold on a ground of golden-brown cloud surmounted by a tiny rose wreath. A set of china of this type was presented to Washington in 1782 by the Count de Custine,[3] one of the French officers who volunteered their services to the American Colonies during the War of the Revolution. Diameter, 8¼ inches; height, 4 inches. Lewis collection. Plate 17. Cat. No. 92379, U.S.N.M.

Wedgwood plate.—Of soft velvety cream color. The bottom is made in imitation of closely woven wickerwork. The sides are of open lathwork. Diameter, 8½ inches. Lewis collection. Plate 18. Cat. No. 92385, U.S.N.M.

Wedgwood fruit dish.—Of soft velvety cream color. The bottom is made in imitation of closely woven wickerwork. The sides are of open lathwork. Diameter, 7½ inches; height, 2¼ inches. Lewis collection. Plate 18. Cat. No. 92384, U.S.N.M.

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[1] The dog "Fo" is the habitual guardian of the Buddhist altar and temple. With its claws, mane, and tail it bears much the semblance of a lion. It is often seen on the top of vases, forming the knob of the cover. See Joseph Marryat, History of Pottery and Porcelain, London, 1868, p. 266.

[2] Mrs. Alice Morse Earle, in her work China Collecting in America, New York, 1892, gives an interesting account of the Washington china, and publishes a letter from Washington to Tench Tilghman, of Baltimore, in connection with a notice which appeared in the *Baltimore Advertiser* of August 12, 1785, announcing the sale of certain chinaware just imported from the East by Captain O'Donnell, of the ship *Pallas.* It is quite probable that the 13 pieces of china described above, as well as the Cincinnati plate described on page 12, were purchased at this time for Washington by Colonel Tilghman.

[3] Adam Philippe, Count de Custine, purchased the Niderviller porcelain factory near Strassburg between 1774 and 1780. The Niderviller pieces are noted for the pureness of their colors and the richness and delicacy of their decorations. Count de Custine was beheaded in 1793.

Three white-china plates.—Circular in shape, with 12 scallops in rim. The bottoms bear the following inscription in red: "MANUFre. Mgr. le DUC Angouleme Paris." Made about 1780 in Paris by Dihl and Guerhard, manufacturers under the patronage of the Duc d'Angouleme. Called "porcellaine d'Angouleme."[1] Diameter, 10 inches; height, 1⅝ inches. Lewis collection. Cat. Nos. 92233, 92235, 92248, U.S.N.M.

Three white-china plates.—In description the same as the three plates noted above (Cat. Nos. 92233, 92235, 92248), but unmarked. Lewis collection. Cat. Nos. 92236, 92237, 92239, U.S.N.M.

White-china fruit dish.—Shape, an irregular pentagon with sides alternately convex and concave. Rim fluted in imitation of a shell. Width, 9½ inches; height, 2 inches. Decorated and marked as plates described above. (Cat. Nos. 92233, 92235, 92248.) Lewis collection. Cat. No. 92353, U.S.N.M.

White-china fruit dish.—Shape, an irregular square. Decorated and marked as the specimen described above. (Cat. No. 92353.) Corners rounded and sides slightly concave. Length of sides, 9 inches. Lewis collection. Cat. No. 92352, U.S.N.M.

White-china bowl.—Circular, with six scallops in rim. A narrow band of gilt about the bottom and the rim. Diameter, 10⅛ inches; height, 4 inches. Lewis collection. Cat. No. 92351, U.S.N.M.

Two white-china platters.—Shape of each, an irregular oval. Rims decorated with scallops and a narrow band of gilt with indented edge on interior. Length, 13¾ inches; width, 10⅝ inches. Lewis collection. Cat. Nos. 92354, 92355, U.S.N.M.

Five white Sevrès china plates.—Decorated with scalloped edges and a narrow band of gilt about the rim. On two of the plates the band of gilt is indented on the interior. Bottom bears in blue two interlaced "L's," the mark used by the Royal Sevres porcelain factory from 1756 to 1777.[2] Diameter, 10 inches; height, 1½ inches. Lewis collection. Cat. Nos. 92234, 92238, 92240–92242, U.S.N.M.

Two white Sevrès china dishes.—Circular in shape, with scalloped edges. Rims decorated with a narrow band of gilt. Bottoms marked as the specimens described above. Diameter, 8⅜ inches; height, 1⅝ inches. Lewis collection. Cat. Nos. 92380–92381, U.S.N.M.

White Sevrès china gravy boat with cover.—Decorated with two narrow indented bands of gilt and one plain band of gilt. Bottom marked as the specimens described above. Length, 9¾ inches; width, 6 inches; height, 4¼ inches. Lewis collection. Cat. No. 92383, U.S.N.M.

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[1] See Marks and Monograms on Pottery and Porcelain, by William Chaffers, London, 1897, page 576.

[2] Sevrès china of this period was usually marked with a letter of the alphabet placed within the cipher, thus indicating the year in which it was made, "A" signifying 1753, and so on. The pieces in the Lewis collection are undated. This, however, is not uncommon. See Chaffers, page 597.

Cincinnati china plate.[1]—Blue and white Canton ware, the interior decorated with a flying figure of Fame with golden-brown wings, blowing a trumpet. The figure is clothed in green with a sash of red, and in the left hand holds suspended from a blue ribbon the insignia of the Society of the Cincinnati. This design is encircled with a single line of dark-brown arrowheads all pointing in the same direction, and immediately beyond is a broad band of diaper pattern. The scalloped rim of the piece is decorated with a design of flowers and butterflies in medium blue with a single outside line of beadwork. Diameter, 9⅝ inches. Gift of Judge Joseph Holt. Cat. No. 123104, U.S.N.M.

"Martha Washington" china cup and saucer.—Part of a set of china presented to Martha Washington by Mr. Van Braam,[2] one of Washington's friends, and on account of the design commonly called "Martha Washington china." Decorated with a sunburst of gold, below which appears a red ribbon scroll inscribed: "Decus et tutamen ab illo." Above, in the center of the sunburst, is a green laurel wreath inclosing the monogram, "M. W." The rims are decorated with gilt lines, immediately below which is a blue and gold serpent. Below this appears a chain of alternate large green and small gold links. Within the green links appear the names of the following States: North Carolina, South Carolina, Georgia, New Hampshire, Massachusetts, Vermont, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and Kentucky. Dimensions of cup: Diameter of base, 1⅝ inches; diameter of top, 3¼ inches; height, with cover, 4¼ inches. Dimensions of saucer: Diameter, 6¼ inches; height, 1½ inches. Lewis collection. Cat. No. 92394, U.S.N.M.

GLASSWARE.

Blue glass bowl.—Probably used for sugar; top lacking. American ware with corrugated surface. Diameter, 5 inches; height, 3 inches. Lewis collection. Cat. No. 92378, U.S.N.M.

Eight rum or punch glasses.—Each plain and keg-shaped, with handle extending nearly the entire height of glass. Diameter, 2½ inches; height, 2½ inches. Lewis collection. Plate 18. Cat. Nos. 92358–65, U.S.N.M.

Two glass tumblers.—(1) Encircled with a succession of parallel raised lines. Diameter, 3½ inches; height, 3 inches. Lewis collection. Cat. No. 92366, U.S.N.M.

(2) Decorated with a delicate design of draped lines and eight-pointed stars. Diameter of bottom, 1¾ inches; diameter of top, 2⅝ inches; height, 3 inches. Lewis collection. Cat. No. 92367, U.S.N.M.

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[1] A number of sets of china bearing the insignia of the Society of the Cincinnati were imported from the Orient by original members of the society. Compare page 16 of this paper, Note 1, and Mrs. Alice Morse Earle's China Collecting in America, page 230.

[2] See copy of Martha Washington's will in Benson J. Lossing's Mount Vernon and Its Associations, page 422; also Mrs. Alice Morse Earle's China Collecting in America, page 240.

Nine wine glasses.—(1) With double base, lower part square, upper part circular. The outside of the rim is decorated with a row of individual daisies. Base, 1⅞ inches square; height, 4⅛ inches. Diameter of top, 2½ inches. Lewis collection. Plate 19. Cat. No. 92368, U.S.N.M.

(2) Cut glass with circular base. Diameter of top, 2 inches; diameter of base, 2⅜ inches; height, 3¾ inches. Lewis collection. Plate 19. Cat. No. 92369, U.S.N.M.

(3) Cut glass with circular base. Diameter of top, 2½ inches; diameter of base, 2½ inches; height, 4 inches. Lewis collection. Cat. No. 92370, U.S.N.M.

(4) Conical, and decorated with a delicate design of four horizontal lines of eight-pointed stars, the individual stars of the top row being inclosed in rectangles, above and below each of which is a line of tiny triangles. Diameter of base, 2¼ inches; diameter of top, 2½ inches; height, 4⅞ inches. Lewis collection. Plate 19. Cat. No. 92372, U.S.N.M.

(5) Cylindrical, ornamented with a design of festooned globes and stars. Between each festoon is a sunburst. Diameter of base, 2⅞ inches; diameter of top, 2¼ inches; height, 7 inches. Lewis collection. Plate 19. Cat. No. 92373, U.S.N.M.

(6) Conical, etched about the top with a band of individual daisies. Diameter of base, 2½ inches; diameter of top, 2⅜ inches; height, 6¼ inches. Lewis collection. Plate 19. Cat. No. 92374, U.S.N.M.

(7 and 8) Two conical champagne glasses. The stems are decorated with cane work in a succession of ascending spiral lines. Diameter of base, 3⅛ inches; Diameter of top 2⅜ inches, height, 7½ inches. Lewis collection. Plate 19. Cat. Nos. 92375–76, U.S.N.M.

(9) Large conical wine glass. The stem is decorated with cane work in a succession of ascending spiral lines. Diameter of base, 3¾ inches; diameter of top, 3½ inches; height, 7½ inches. Lewis collection. Plate 19. Cat. No. 92377, U.S.N.M.

Glass decanter.—Neck and base scalloped. Diameter, 3⅝ inches; height, 8⅛ inches. Lewis collection. Cat. No. 92371, U.S.N.M.

PERSONAL RELICS OF WASHINGTON.

Infant's robe.—White brocade silk lined with old-rose China silk. About two-thirds of the lining is lacking. Used on the occasion of Washington's christening. Size, 36 by 37 inches. Lewis collection. Cat. No. 92223, U.S.N.M.

Continental Army uniform.—Coat, without military insignia, of dark-blue cloth with buff facings and plain gilt buttons. Waistcoat of buff cloth with plain gilt buttons. Knee breeches of buff cloth. Worn by Washington when he resigned his commission before Congress as Commander in Chief of the Continental Army at

Annapolis, Maryland, December 23, 1783. Presented to the United States Government by George Washington Parke Custis and placed in the U. S. Patent Office. Transferred to the U. S. National Museum in 1883. Plate 20. Cat. Nos. 92641–43, U.S.N.M.

Waistcoat and small clothes worn by Washington.—Waistcoat of buff woolen cloth; collar, front, and pocket flaps and buttons embroidered with blue and yellow silk. Knee breeches of buff silk, and knee breeches of buff cloth. Presented to the United States Government by George Washington Parke Custis and placed in the U. S. Patent Office. Transferred to the U. S. National Museum in 1883. Cat. Nos. 92644–46, U.S.N.M.

Tents used by Washington during the War of the Revolution.[1]—(1) *Sleeping tent roof and sides.*—Ends lacking. Made of a single rectangular piece of white home-woven linen with a striped design of interwoven parallel lines. Door strip of same material, 51 inches square. Length on ridge pole, 8 feet; roof slant, 6 feet; height of side wall, 6 feet. Presented to the United States Government by George Washington Parke Custis in 1844 and placed in the U. S. Patent Office.[2] Transferred to the U. S. National Museum in 1883. Cat. No. 92552, U.S.N.M.

(2) *Marquee tent.*—Oval-shaped roof, made of heavy home-woven linen. Edge scalloped and faced with strip of home-woven red flannel. Thirteen seams on ends, seven seams in central piece. Two holes in roof for supporting poles. Twenty guy ropes attached to top. Length on ridge pole, 13½ feet; roof slant, 10 feet; circumference, 80 feet. Side wall of same material, rectangular in shape. Height, 5 feet 6 inches; length, 80 feet. Lent by Miss Mary Custis Lee. Cat. No. 2083, U.S.N.M.

(3) *Marquee tent roof.*—Oval in shape Made of home-woven heavy brown woolen material. Length on ridge pole, 13 feet; roof slant, 9 feet; circumference, 75 feet. Side wall lacking. Lent by Miss Mary Custis Lee. Cat. No. 2084, U.S.N.M.

Tent poles, pegs, and pouches.—(1) *Oak ridge pole,* in three sections. Length united, 12½ feet; diameter, 4 inches. Ends of each section protected by heavy iron bands 3¾ inches long, those on the ends of the middle section projecting beyond the wood and forming sockets for the ends of the next section. Lent by Miss Mary Custis Lee. Cat. No. 2082, U.S.N.M.

(2) *Oak upright pole.*—In two sections. Ends of each section protected with heavy iron bands. Diameter, 4 inches; length, 12 feet. Lent by Miss Mary Custis Lee. Cat. No. 2082, U.S.N.M.

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[1] On the occasion of the visit of Lafayette to the city of Baltimore in 1824, one of these tents was taken to that city by the owner, G. W. P. Custis, and having been set up was used by the members of the Society of the Cincinnati at a reception tendered Lafayette. See the *American and Commercial Daily Advertiser* of Baltimore for Sept. 13, 14, 16, and Oct. 9, 1824.

[2] It is probable that while in the field this small tent of very light material was set up within a marquee and used by the commander in chief as a sleeping compartment, and hence its name. See Lossing's Mount Vernon and Its Associations, p. 138.

(3) *Two door posts.*—Slender spruce poles with pointed ends for tent door. Length, 6 feet 6 inches; diameter, 2 inches. Lent by Miss Mary Custis Lee. Cat. No. 2082, U.S.N.M.

(4) *Twenty-three oak pegs.*—With notched heads and sharpened ends and varying in length from 9 inches to 20 inches. Lent by Miss Mary Custis Lee. Cat. No. 2087, U.S.N.M.

(5) *Three tent pouches.*—(1) Leather pouch lined with heavy brown canvas. Ends padded. Cylindrical in shape, with outside flaps secured with strings. Length, 3 feet 3½ inches; diameter, 18 inches. Lent by Miss Mary Custis Lee. Cat. No. 2086, U.S.N.M. (2) Canvas pouch for pegs. Rectangular in shape with holes along the edges for draw strings. Length, 26 inches; width, 21½ inches; height of sides, 5 inches. Lent by Miss Mary Custis Lee. Cat. No. 2085, U.S.N.M. (3) Section of tent pouch of canvas. Rectangular in shape with holes for draw strings on the edges. Length, 5 feet 2 inches; width, 4 feet 5 inches. Lent by Miss Mary Custis Lee. Cat. No. 2085, U.S.N.M.

Original manuscript company roll and muster of the guard of Washington when Commander in Chief of the Continental Army.—Muster, certified to on the inspection of July, 1782, by W. Barber, major and assistant inspector of the Northern Army, and the roll of the true state of the company, certified to September 7, 1782, by W. Colfax, lieutenant commandant. (See Appendix 2 for copy of this document.) Size, 12 by 20 inches. Gift of Capt. James M. Miller, U. S. Army. Plate 21. Cat. No. 97031, U.S.N.M.

Original diploma of membership of Dr. David Townsend, of Massachusetts, in the Society of the Cincinnati.—Dated May 5, 1784. Engraved on parchment and signed by "Geo. Washington, President," and "H. Knox, Secretary," of the society. Lent by Thomas Gerry Townsend.[1] Cat. No. 256887, U.S.N.M.

Camp mess chest.—Used by Washington during the War of the Revolution. Constructed of strips of oak and pine, the interior lined with heavy green woolen material and the exterior covered with dark leather. Edges studded with brass-headed tacks and the corners faced with strips of iron. Iron handle on either end and lid fitted with iron hinges, fastened with flat lock and with hasp and padlock. Interior divided into fourteen compartments and containing a tray with nine compartments. Height, 10¾ inches; width, 14 inches; length, 21¼ inches. Chest with outfit described below bequeathed to the Government in 1844 by William Sidney Winder.[2] Transferred from the U. S. Patent Office to the U. S. National Museum in 1883. Plate 22. Cat. No. 92599, U.S.N.M.

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[1] The Museum collections also include 38 pieces of chinaware decorated with the monogram "D. T." and the insignia of the Society of the Cincinnati. These were imported from China for Doctor Townsend in 1790. Lent by Thomas Gerry Townsend. Cat. Nos. 256878-256884, U.S.N.M.

[2] See Congressional Globe, vol. 13, p. 536.

Outfit of mess chest.—(1) *Four cylindrical tin pots* with detachable wooden handles; two with tops, two without tops. The dimensions of these are as follows: (*a*) Height, 7¾ inches; diameter, 7¾ inches; length of handle, 7¾ inches. (*b*) Height, 7 inches; diameter, 6⅝ inches; length of handle, 7¾ inches. (*c*) Height, 7¼ inches; diameter, 6 inches; length of handle, 7½ inches. (*d*) Height, 7½ inches; diameter, 4½ inches; length of handle, 6½ inches. Plate 22. Cat. Nos. 92622–25, U.S.N.M.

(2) *Six tin plates.* These vary in diameter from 9½ to 8½ inches. Cat. Nos. 92629–34, U.S.N.M.

(3) *Three tin platters.* Oval in shape and varying in size from 13½ by 9½ inches to 12⅞ by 8⅞ inches. Cat. Nos. 92626–28, U.S.N.M.

(4) *Two knives.* Steel blades with oak handles painted black. Length, 6¼ inches. Cat. Nos. 92615–16, U.S.N.M.

(5) *Four two-tined forks.* Handles of oak painted black. Length, 6¼ inches. Cat. Nos. 92617–20, U.S.N.M.

(6) *Gridiron* with collapsible legs and handle, and eight parallel bars. Size, 6¼ inches square; length of legs, 2⅞ inches; length of handle, 5⅜ inches. Cat. No. 92621, U.S.N.M.

(7) *Tinder box.* Rectangular, tin, with small square opening in top closed with a slide. Height, 3 inches; width 3⅜ inches; length, 5⅜ inches. Cat. No. 92600, U.S.N.M.

(8) *Tinder box.* Rectangular, tin, with hinged lid. Height, 2¾ inches; width, 5¼ inches; length, 5½ inches. Cat. No. 92601, U.S.N.M.

(9) *Glass bottle, square shaped.* For salt, with pewter top. Base, 1½ inches square; height, 3 inches. Cat. No. 92604, U.S.N.M.

(10) *Glass bottle, square shaped.* For pepper, with perforated pewter top. Base, 1½ inches square; height, 3 inches. Cat. No. 92603, U.S.N.M.

(11)[1] *Three glass bottles.* Each square shaped, with small neck, fitted with cork stopper. Dimensions of each: Base, 1½ inches square; height, 3 inches.

(12) *Glass bottle.* Rectangular in shape, with small neck, fitted with cork stopper. Base, 1½ inches by 3 inches; height, 8½ inches.

(13) *Two glass bottles.* Each rectangular in shape, with small neck, fitted with cork stopper. Dimensions of each: Base, 3⅜ inches by 3⅝ inches; height, 8½ inches.

(14)[1] *Two glass bottles.* Each rectangular in shape, with small neck, fitted with cork stopper. Dimensions of each: Base, 3 inches by 4½ inches; height, 5½ inches.

(15) *Knitted green woolen bag.* Divided into seven interior compartments by longitudinal strips of cloth. A narrow strip of tape is

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[1] The stoppers of the bottles described under headings 11-14 are each fitted with a brass ring attached to the top for convenience in handling.

fastened about the sides with ends for tying. Size, 9 by 7 inches. Cat. No. 92614, U.S.N.M.

Surveyor's compass.—Circular case of mahogany, bound with a narrow strip of iron. Horizontal bar and standards of brass. Compass face of highly polished metal marked with an eight-pointed star indicating the cardinal and intermediate points, and covered with glass top. Inscribed: "Rittenhouse, Philadelphia."[1] Used by Washington at Mount Vernon. Presented to the United States Government by Anthony Kimmel. Deposited in the U. S. Patent Office, and transferred to the U. S. National Museum in 1883. Diameter of compass, 6½ inches; length of horizontal bar, 14 inches; height of standards, 6 inches. Plate 23, Cat. No. 92538, U.S.N.M.

Manuscript correspondence relating to compass.—Fourteen letters written in 1851 and 1852 by Anthony Kimmel, George Washington Parke Custis, and others, concerning the surveyor's compass described above. Bound together with a copy of the work by Henry T. Tuckerman, entitled "Character and Portraits of Washington," which was published by J. Putnam, New York, in 1850. Inscribed in gold letters on the cover, "The Correspondence relating to the Surveyor's Compass of Gen. George Washington." Dimensions, 11½ by 9 by 1⅝ inches. Transferred from the U. S. Patent Office in 1883 to the U. S. National Museum. Cat. No. 92542, U.S.N.M.

Spyglass.—Tube, nine-sided, wound closely with a single thickness of twine. Marked with the maker's name, "Cole, Fleet Street, London." Used by Washington at Mount Vernon largely for viewing boats on the Potomac. Diameter of object lens, 2¾ inches; diameter of eye lens, 1 inch; length, 63 inches. Lewis collection. Cat. No. 92423, U.S.N.M.

Field glass and case.—Brass tube, in three sections, with case of russet leather. Used by Washington during the War of the Revolution. Diameter of object lens, 1¾ inches; diameter of eye lens, 1⅛ inches; length, closed, 9 inches; opened, 22½ inches. Length of case, 9½ inches; diameter, 2½ inches. Lewis collection. Plate 24. Cat. Nos. 92424–25, U.S.N.M.

Portable writing case.—Rectangular mahogany box, the lid covered with black grained leather and lined with paper. Interior divided into five compartments for paper, pens, pencils, and sealing wax. Lid fitted with two brass hinges and a brass lock. To the side of the case is affixed a large folding pocket of black grained leather for stationery. Used by Washington during the War of the Revolution. Presented to the Government in 1845 by Dr. Richard Blackburn. Placed in the U. S. Patent Office, and in 1883 transferred to the U. S. National Museum. Dimensions: 14¼ by 14¾ by 3¾ inches. Plate 25. Cat. No. 92529, U.S.N.M.

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[1] David Rittenhouse (1732–1796) was one of the most noted of American astronomers during the latter half of the 18th century and manufactured mathematical instruments of exceptional accuracy.

Shaving glass.—In rectangular wooden case with drawer, the interior and exterior covered with a decorative paper. Part of top lacking. Used by Washington during the War of the Revolution. Dimensions of case, 9¼ by 11¼ by 1⅝ inches. Lewis collection. Cat. No. 92411, U.S.N.M.

MISCELLANEOUS RELICS.

Iron treasure chest.—Made of heavy sheets of wrought iron, the edges faced with wide strips of the same material, the whole joined by heavy bolts, lid fitted to the back with three heavy hinges and secured in front with one flat lock and two padlocks over iron hasps. Owned by Daniel Parke Custis, first husband of Martha Washington, and later used by General and Mrs. Washington at Mount Vernon as a receptacle for valuables. Bequeathed by Mrs. Washington to George Washington Parke Custis.[1] Dimensions, 20½ by 12¾ by 11½ inches. Lent by Miss Mary Custis Lee. Cat. No. 2090, U.S.N.M.

English keyed zither owned by Nellie Custis.—The body of the instrument is pear-shaped with sounding board of fir, and back, sides, and neck of maple. The sounding board is decorated about the edge with a painted circlet of green leaves. A circular hole in the sounding board is filled in with an ivory piece which has six small holes across the center and is decorated in open work with the initials "E. P. C." and with small designs. Fingerboard faced with ivory. Bridge of ivory. The instrument is fitted with 12 steel strings. On one side of the bridge is a keyboard with six keys which actuate six hammers, the heads of which rise through the top between the bridge and the neck and strike the underside of the strings. The mechanism of the keyboard is fitted in a drawer located within the body of the piece. Inscribed Longman & Broderip, London. Presented by Washington to Eleanor Parke Custis as a birthday gift. Length, entire, 28 inches; length of body, 16 inches; width, 12 inches; height, 3¾ inches. Lewis collection. Plate 26. Cat. No. 92408, U.S.N.M.

Zither case.—For the instrument described above. Made of pine wood and covered with russet leather decorated with floral designs in gold. The lid is fastened with a small, flat lock and the interior lined with bright yellow woolen cloth. Length, 31 inches; width, 13 inches; height, 6¼ inches. Lewis collection. Cat. No. 92409, U.S.N.M.

Mahogany music case.—Rectangular in shape. Divided longitudinally into nine compartments by narrow oak strips, the tops of which are carved in an elongated heart shape. Lid secured at the back by two small brass hinges and in front by flat brass lock. Used by Eleanor Parke Custis at Mount Vernon. Length, 23 inches;

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[1] See copy of Mrs. Washington's will in Benson J. Lossing's Mount Vernon and Its Associations, p. 421.

width, 15 inches; height, 12 inches. Lewis collection. Cat. No. 92401, U.S.N.M.

Chinese tea chest.—Square box of wood with sliding lid. Decorated with Chinese landscape scenes in mother-of-pearl inlaid on a background of black lacquer. Dimensions: 12¾ by 12¾ by 13 inches. Lewis collection. Cat. No. 92406, U.S.N.M.

Chinese tea chest.—Rectangular box of wood covered with Chinese paper. Lid fastened with hooks and two brass hinges. Interior side of lid decorated in colors with humming birds and flowers. Exterior of either end decorated with floral designs within circles. Back, front, and top of lid bear Chinese scenes. Dimensions: 14 by 14 by 8 inches. Lewis collection. Cat. No. 92403, U.S.N.M.

Mahogany chest.—Rectangular in shape and made of heavy pieces of mahogany. The edges are reinforced with brass knees and the bottom is fitted with four casters. The interior is lined with green baize. Presented to Washington by his half brother, Lawrence, and used at Mount Vernon as a receptacle for silver plate. Dimensions, 23 by 36 by 26 inches. Lewis collection. Cat. No. 92407, U.S.N.M.

Gold medal commemorating the death of Washington.—The obverse bears the bust of Washington and the inscription: "He is in glory and the world in tears. G. W. Ob. D. 14, 1799." Inclosed in an oval brass frame. The reverse of the medal is covered by a miniature landscape painting on ivory, in the foreground of which stands a weeping female figure. Diameter of medal, 1 inch; diameter of frame, 2¾ inches. Lent by Seth Banister Robinson. Cat. No. 232450, U.S.N.M.

Dress sleeve.—Green velvet embroidered with gilt braid and silver and gilt spangles in a set pattern of flowers and leaves. Lined with cream-colored silk. From one of Mrs. Washington's costumes. Entire length, 13 inches; width of cuff, 8 inches; width of sleeve, 4 inches. Lewis collection. Cat. No. 92222, U.S.N.M.

Worsted lamp mat.—Knitted by Martha Washington and used on the library table at Mount Vernon. Circular in shape and composed of twenty blue, brown, and white sections. Diameter, 8 inches. Lewis collection. Cat. No. 92404, U.S.N.M.

Coach panel.—Door panel from coach used by Washington. Copper, decorated in brown with three cupids and wreaths of flowers, by the Italian artist, Cipriani. Presented to the National Institute by Mrs. Mary Dunlap, and transferred from the U. S. Patent Office, in 1883, to the U. S. National Museum. Oak frame, 15 by 17 inches; oval exposure of panel, 8¾ by 10¼ inches. Cat. No. 92537, U.S.N.M.

Invitation card.—Bears in black the inscription: "The President of the United States and Mrs. Washington request the pleasure of ——— company to dine, on ——— next, at —— o'clock, ——— 179—. An answer is requested." Size, 4¾ by 3 inches. Gift of John M. Noah. Cat. No. 96955, U.S.N.M.

APPENDIX 1.

Extract from a letter from Ellis Spear, U. S. Commissioner of Patents, May 6, 1878, to the Honorable Carl Schurz, Secretary of the Interior, concerning the Lewis collection of Washington relics:

"In compliance with your order, I have carefully examined these relics and submit the following report:

"The relics consist of a large number of articles chiefly of personal and household use.

"The following inventory was made by the family and has been carefully verified by me.

"One large mirror; two small mirrors.

"One dozen handsome parlor chairs.

"Two armchairs.

"One large easy chair in which the general sat a few minutes before his death.

"One double brass candlestick by which the farewell address was written.

"Two silver-plated candlesticks.

"One large and two small plated waiters.

"One field glass used in the Revolution.

"One spyglass also used in the war.

"Knives and forks.

"One plated cake basket.

"One large mahogany box in which silver plate was kept.

"Two mahogany footstools and three carpet-covered footstools.

"The robe in which he was christened.

"Three silver-plated lamps.

"Half dozen silver-plated salt cellars.

"Thirty-six pieces of chinaware.

"One bedstead presented to Mr. Lawrence Washington by his friend, Admiral Vernon, and by Lawrence left to his brother, the general.

"One marble-top table 4 feet in length by 3 feet in breadth.

"One guitar presented by General and Mrs. Washington to Miss Nellie Custis.

"Miniature portraits of General and Mrs. Washington on wood, painted by Trumbull.

"One shaving glass in frame with drawer.

"An engraving of the Countess of Huntingdon presented by her to General Washington.

"Several souvenirs of Washington, consisting of ornamental works and household articles.

"All of these relics have been continuously in the possession of the Lewis family since the death of General Washington. They were received by Mrs. Lewis, who was the adopted daughter of General Washington and the wife of Major Lawrence Lewis, his nephew, and were in her possession until her death in 1852, when they passed into the hands of the family now having them in charge. They are all in an excellent state of preservation, and of the genuineness of every article there can be no doubt whatever.

"The miniature portraits were considered excellent likenesses and are now in good condition.

"The articles of household use are all in their original condition and illustrate the style of living of the first President of the United States. The whole collection is far superior to that now in the possession of the Government.

"The total number of articles enumerated is more than ninety, and, added to those now in the possession of the Government, they would form, I think, by far the largest and best collection of relics of Washington that could now be made.

"The family were reluctant to part with these relics, but were impelled by the consideration that inevitably in a few years with the separation of the family the articles would be scattered, and perhaps a large number of them in the course of time lost or destroyed. They felt also that every citizen of the country who shared with them an interest in Washington would be glad to have these relics made public property and placed where they would be accessible to all.

"The small collection now in the possession of the Government is visited by thousands of people every year.

"The addition thereto of the articles now offered would constitute a most complete and interesting collection and would insure the preservation of these valuable relics."

APPENDIX 2.

ROLL AND MUSTER OF THE COMMANDER IN CHIEF'S GUARD FOR THE MONTH OF JULY, 1782.

Ranks.	Names.	Term of enlistment.	Casualties.
Lieutenant	William Colfax		
Lieutenant	Levi Holden		
Sergeants	William Hunter		
	James Frazer		On command after deserters, 22 July.
	John Phillips		
	Davis Brown		
Corporals	John Arnold		
	Samuel Wortman		
	John Dent		
	John Herrick		
Drums and fifes	Jared Goodrich		
	Isaac Manning		
	Frederick Park		
	Diah Manning, drum major		
	Cornelius Willson		
	John Fenton		
Privates 1	Jonathan Moore		
2	Timothy Smith		
3	Samuel Baily		
4	John Cole		
5	Elihu Hancock		
6	Ruben Thompson		
7	John Patton		
8	Peter Holt		
9	Edward Weed		
10	Benjamin Bonnel		
11	Thomas Forrest		
12	Jeremiah Driskill		
13	Joseph Vinall		
14	Robert Findley		
15	Thomas Gillen		
16	John Robertson		
17	William Karnahin		
18	John Douther		
19	Hugh Cull		
20	Reaps Mitchell		
21	Randolph Smith		
22	Daniel Hymer		
23	Ebenezer Carleton		
24	Benjamin Eaton		
25	James Dougherty		
26	Joel Crosby		
27	James Hughes		
28	Lewis Flemister		
29	Lewis Campbell		
30	Jacob Scriver		
31	Jedediah Brown		
32	William Pace		
33	Dennis Moriarty		
34	Stephen Hatfield		
35	Simeon Lothrop		
36	William Martin		
37	John Montgomery		
38	John Finch		
39	Labon Landon		
40	Samuel Smith		Sick at Hospital, New Windsor.
41	Joseph Timberlake		
42	William Tanner		
43	Edward Wiley		
44	Solomon Daley		Do.
45	Enoch Wells		
46	William Coram		Do.
47	Robert Blair		
48	William Henussey		Do.
49	Levi Deane		
50	James Dady		
51	John Barton		
	John Paddington		

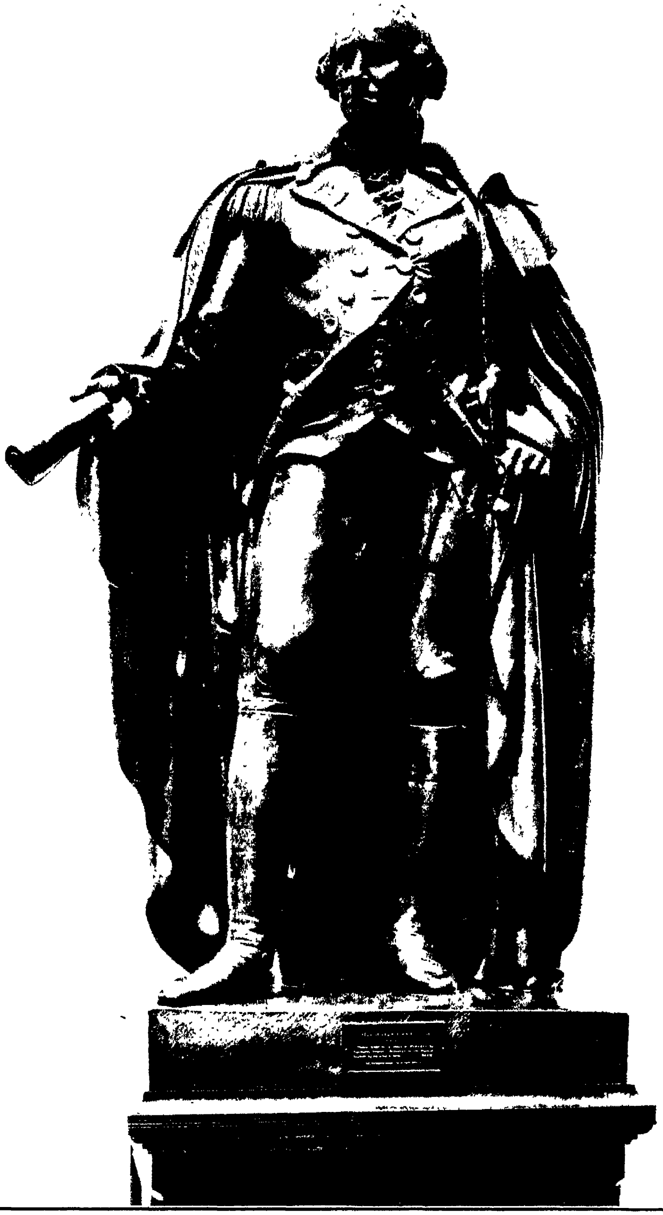
I certify the above roll to be the true state of said company seventh day of September, 1782.

W. COLFAX, *Ltcmdt., Comdr. in Chief's Guard.*

Ranks.	Mustered.	Time since last muster or enlistment.	Alterations since last muster.
Lieutenant	William Colfax	June 30	
Do	Levi Holden	do	
Sergeants	William Hunter	do	
		do	
	John Phillips	do	
	Davis Brown	do	
Corporals	John Arnold	do	
	Samuel Wortman	do	
	John Dent	do	
	John Herrick	do	
Drums and fifes	Jared Goodrich	do	
	Isaac Manning	do	
	Frederick Park	do	
	Diah Manning	do	
	Cornelius Willson	do	
	John Fenton	do	
Privates 1	Jonathan Moore	do	
2	Timothy Smith	do	
3	Samuel Baily	do	
4	John Cole	do	
5	Elihu Hancock	do	
6	Ruben Thompson	do	
7	John Patton	do	
8	Peter Holt	do	
9	Edward Weed	do	
10	Benjamin Bonnel	do	
11	Thomas Forrest	do	
12	Jeremiah Driskill	do	
13	Joseph Vinall	do	
14	Robert Findley	do	
15	Thomas Gillen	do	
16	John Robertson	do	
17	William Karnahin	do	
18	John Douther	do	
19	Hugh Cull	do	
20	Reaps Mitchell	do	
21	Randolph Smith	do	
22	Daniel Hymer	do	
23	Ebenezer Carleton	do	
24	Benjamin Eaton	do	
25	James Dougherty	do	
26	Joel Crosby	do	
27	James Hughes	do	
28	Lewis Flemister	do	
29	Lewis Campbell	do	
30	Jacob Scriver	do	
31	Jedediah Brown	do	
32	William Pace	do	
33	Dennis Moriarty	do	
34	Stephen Hatfield	do	
35	Simeon Lothrop	do	
36	William Martin	do	
37	John Montgomery	do	
38	John Finch	do	
39	Labon Landon	do	
40		do	
41	Joseph Timberlake	do	
42	William Tanner	do	
43	Edward Wiley	do	
44		do	
45	Enoch Wells	do	
46		do	
47	Robert Blair	do	
48		do	
49	Levi Deane	do	
50	James Dady	do	
	John Barton	do	
	John Paddington	do	Deserted July 13.

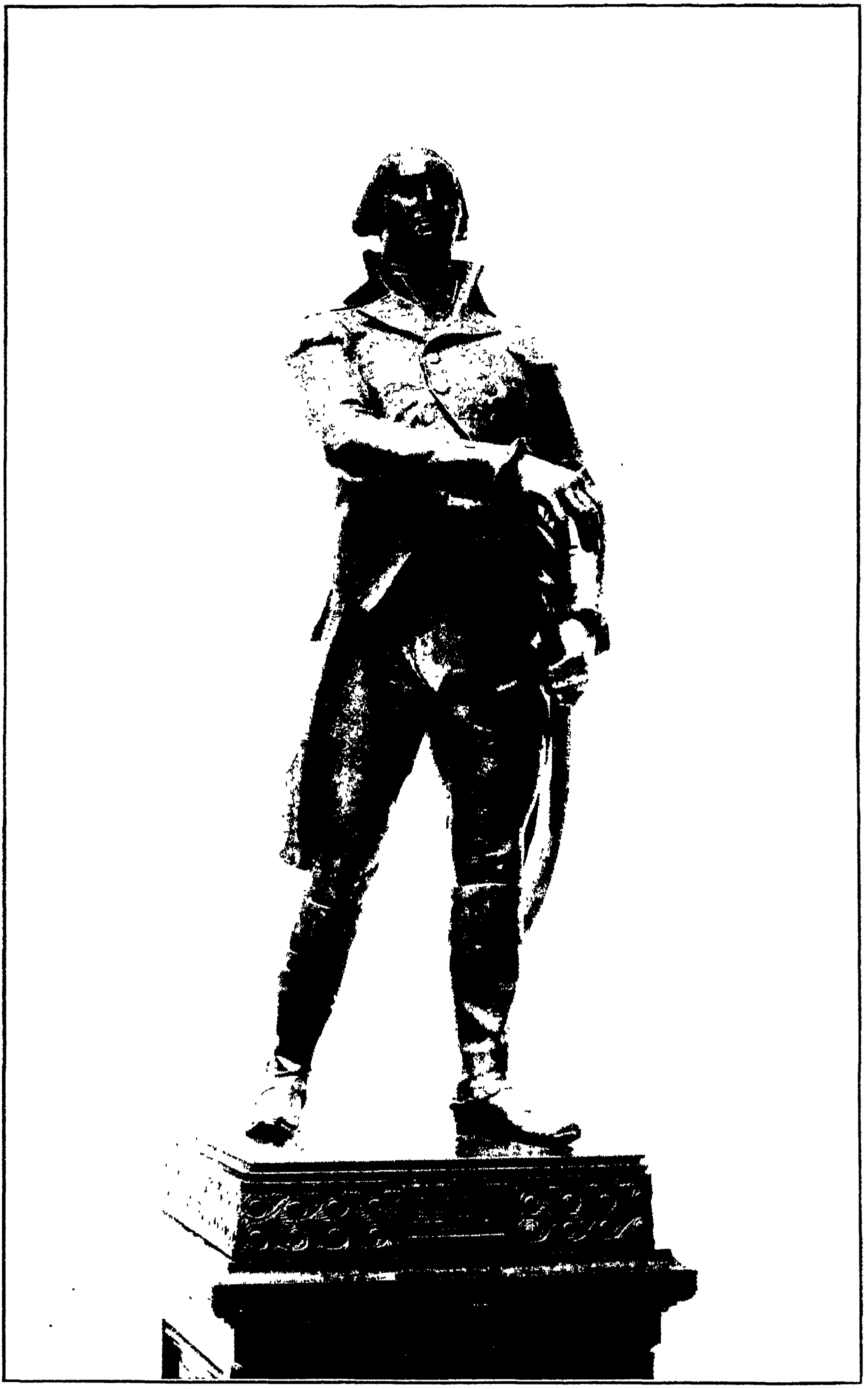
I certify the above muster to be true in all its contents, inspection of July, 1782.

W. Barber,
Major and Assistant Inspector of the Northern Army.



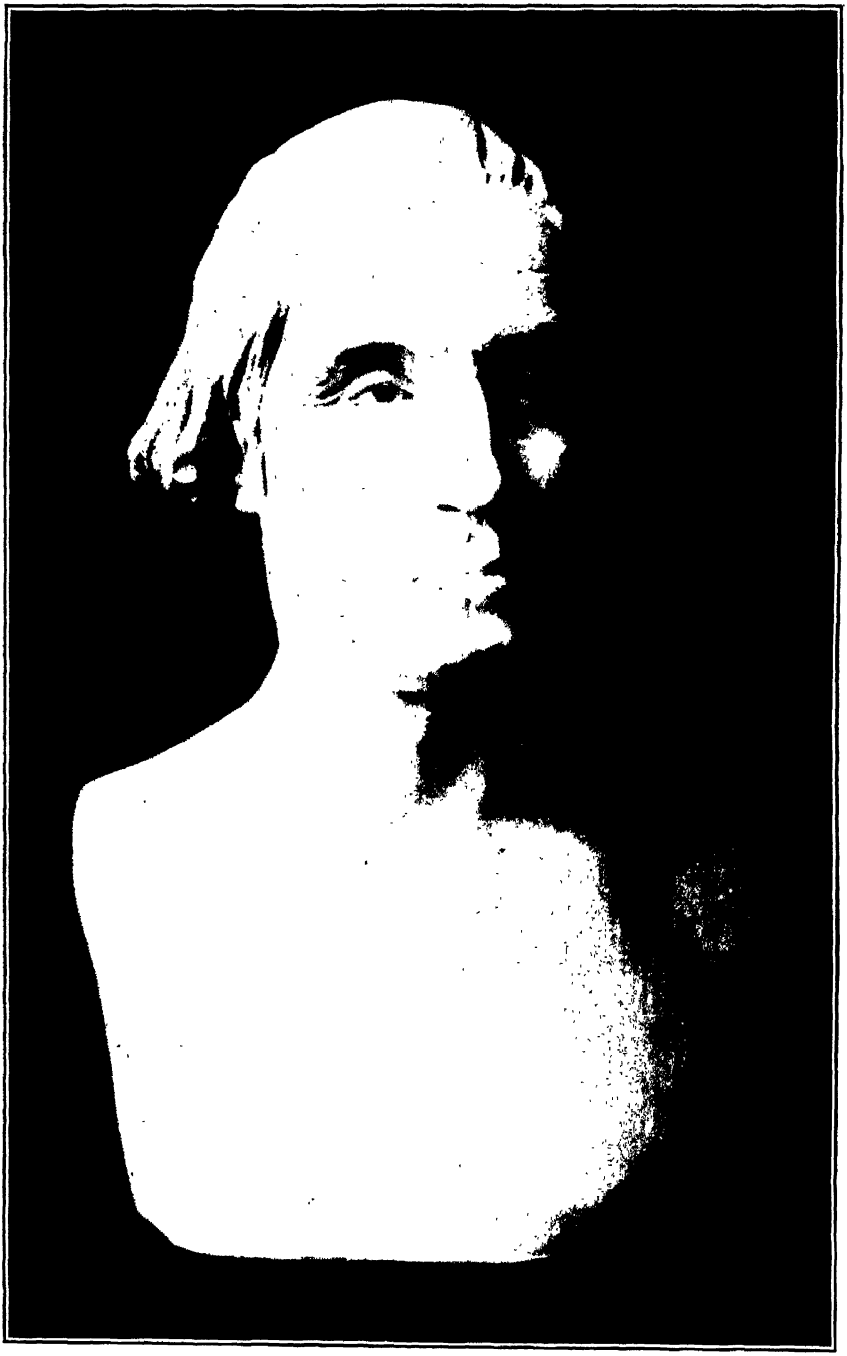
Plaster Statue of Washington by Ferdinand Pettrich.

For explanation of plate see page 3.



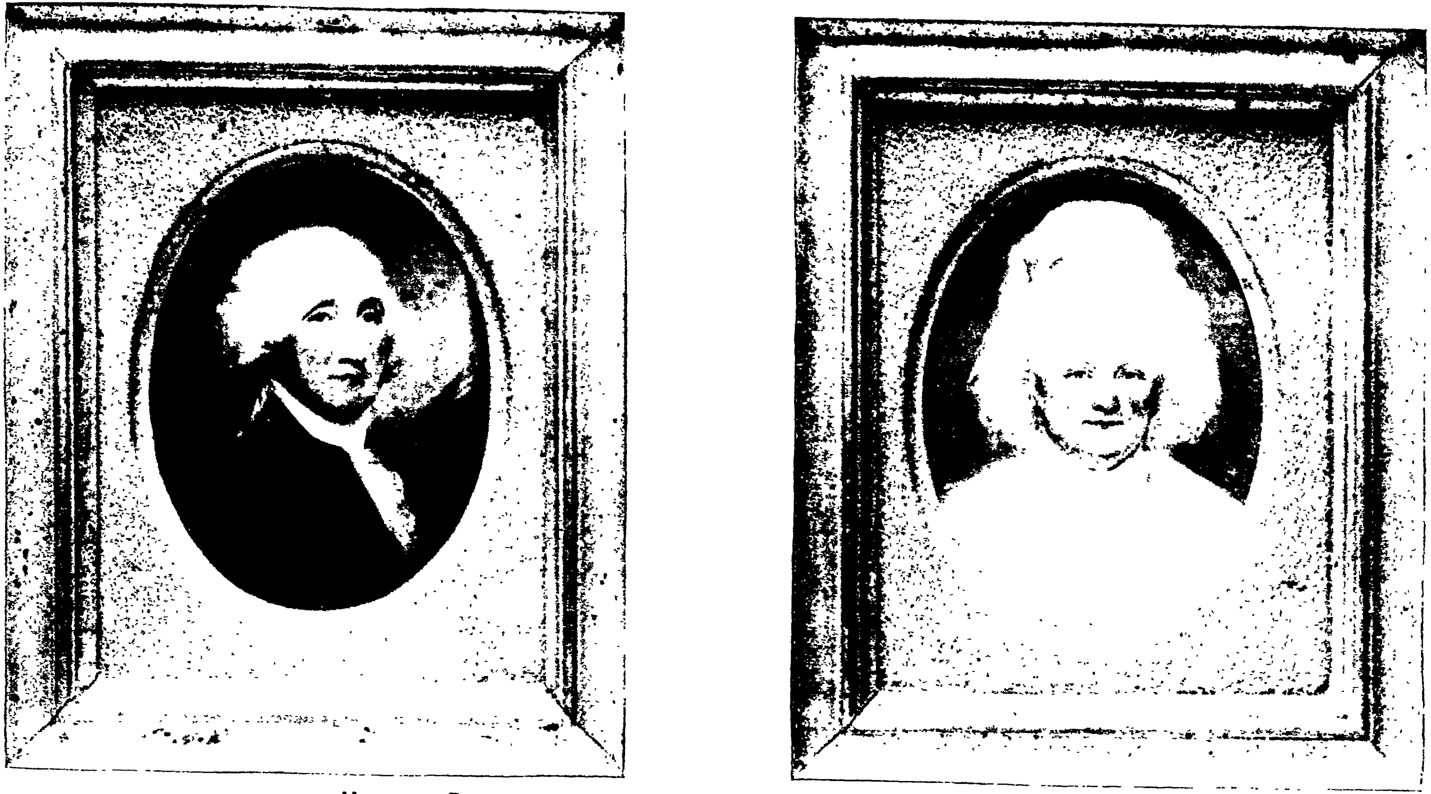
PLASTER STATUE OF WASHINGTON BY WILLIAM R. O'DONOVAN.

FOR EXPLANATION OF PLATE SEE PAGE 3.



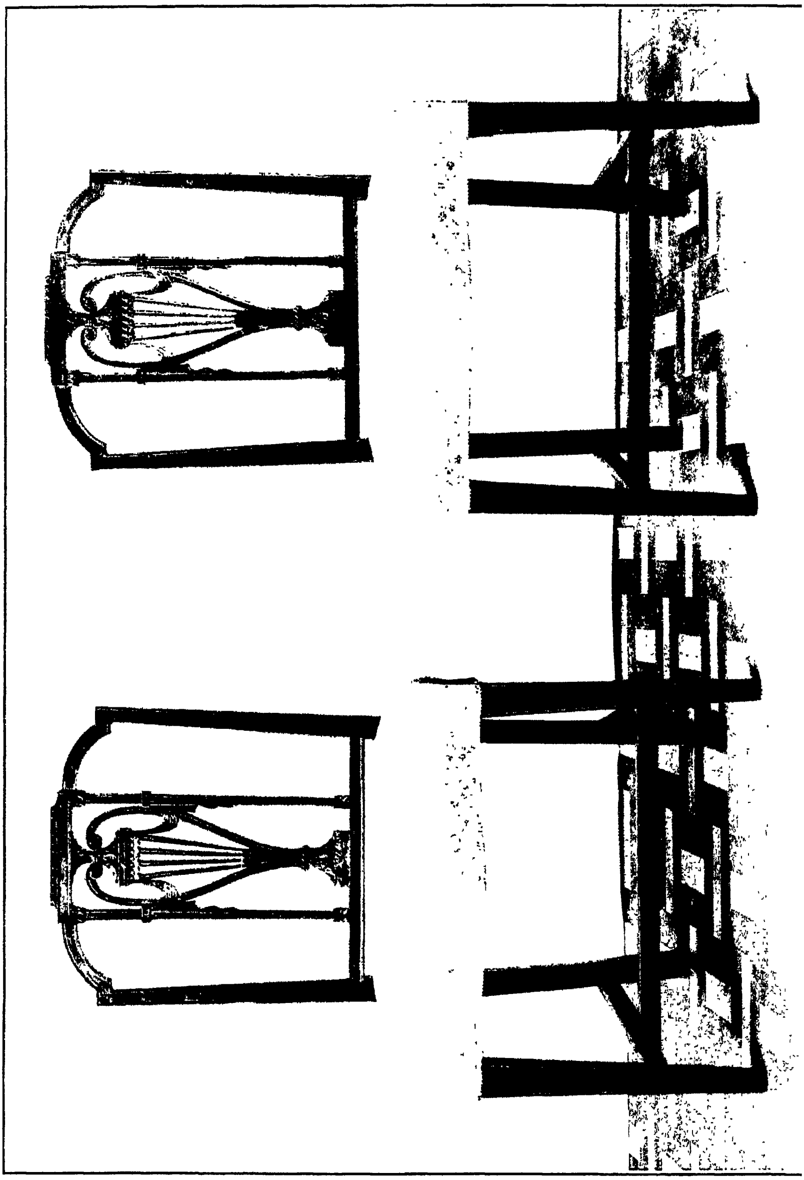
Plaster Copy by Clark Mills of Houdon's Bust of Washington.

For explanation of plate see page 3.



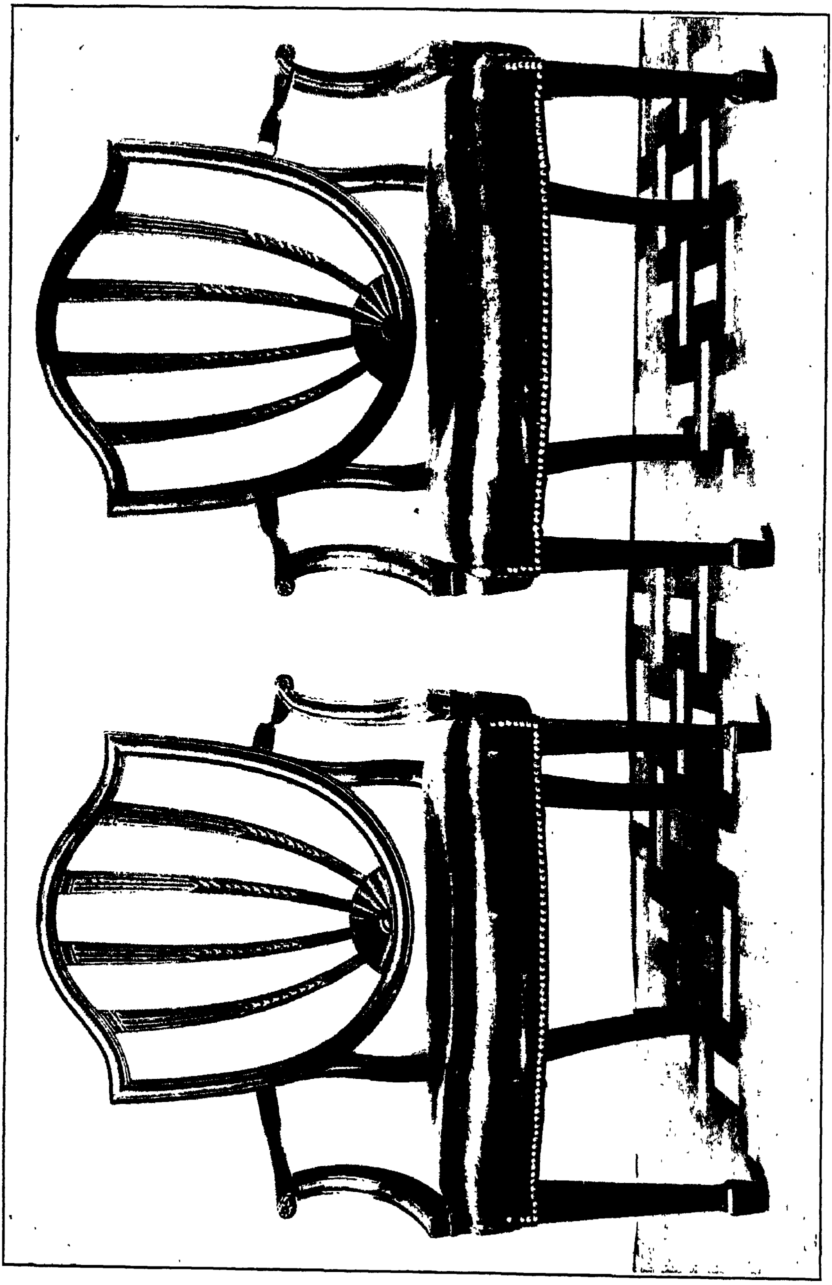
Miniature Portraits of General and Mrs. Washington by John Trumbull.

For explanation of plate see page 3.



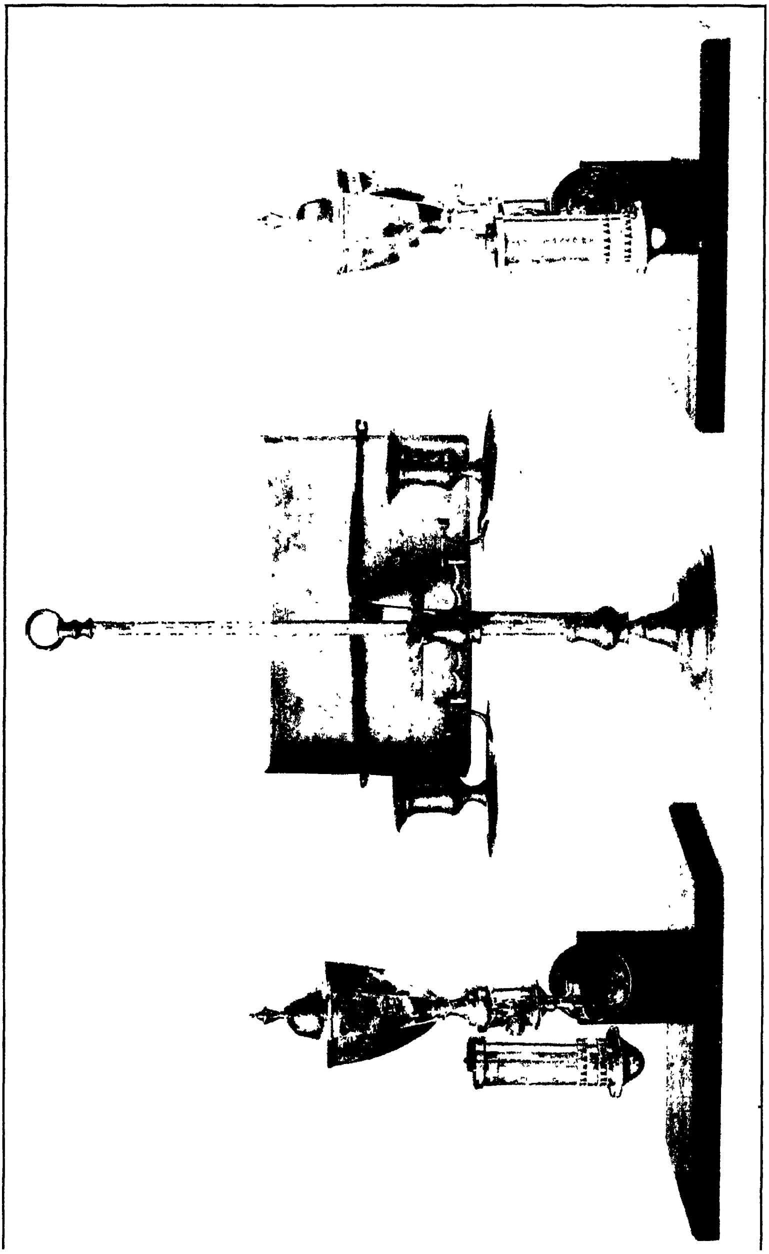
BLACK WALNUT CHAIRS.

FOR EXPLANATION OF PLATE SEE PAGE 4.



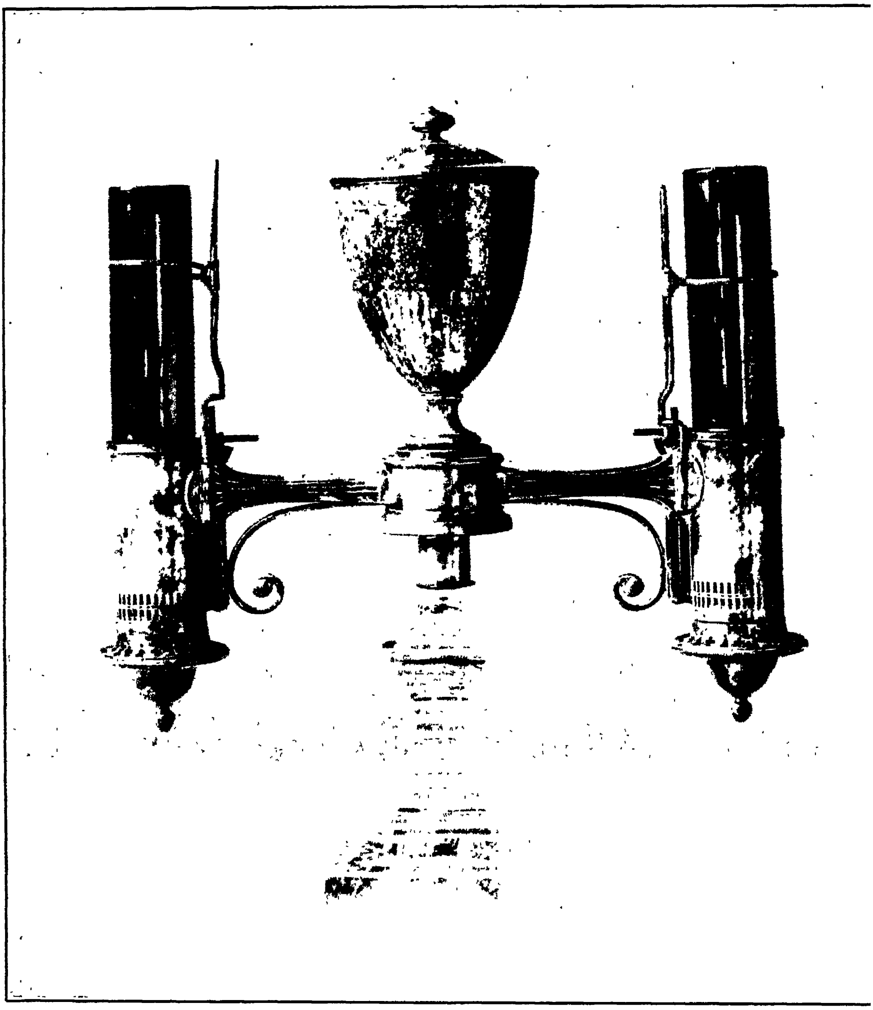
Mahogany Armchairs.

For explanation of plate see page 5.



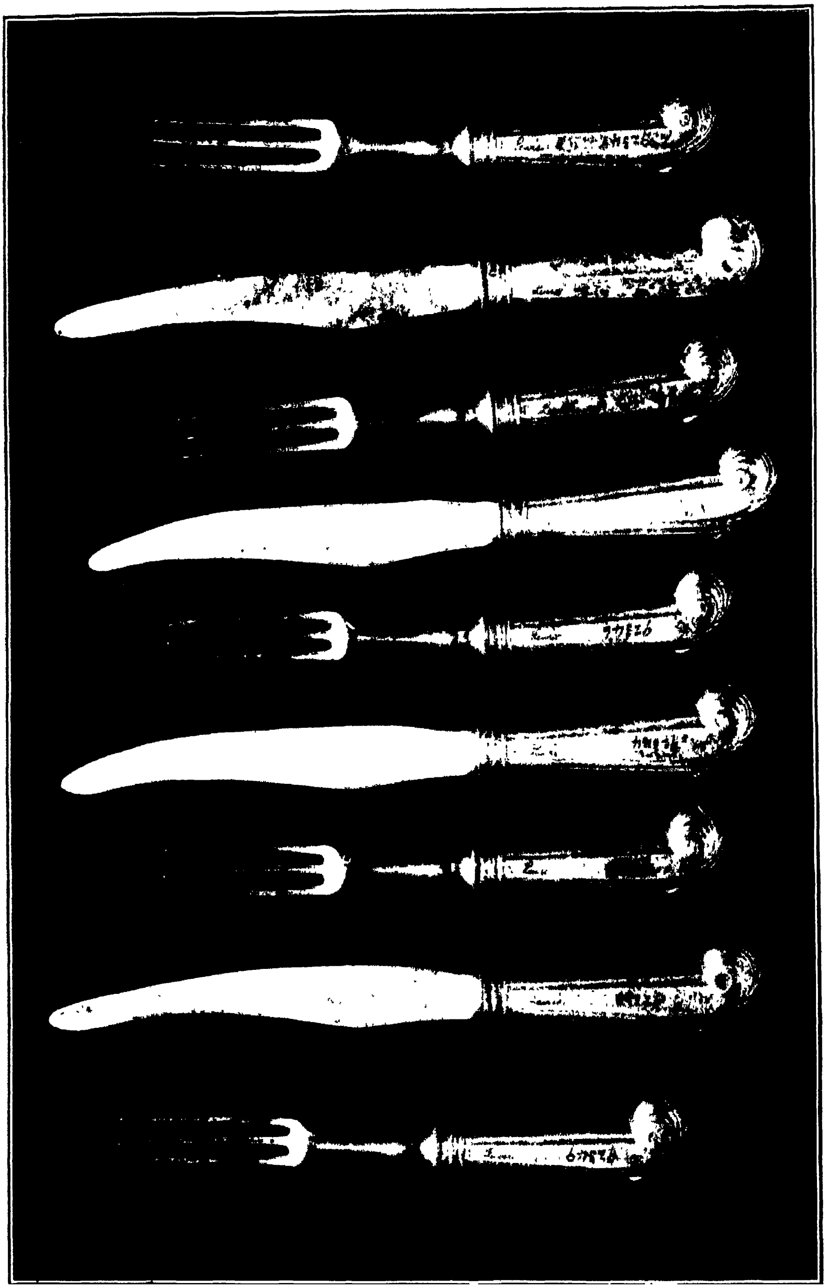
SILVER-PLATED WALL-BRACKET LAMPS AND BRASS CANDELABRUM.

FOR EXPLANATION OF PLATE SEE PAGE 7.



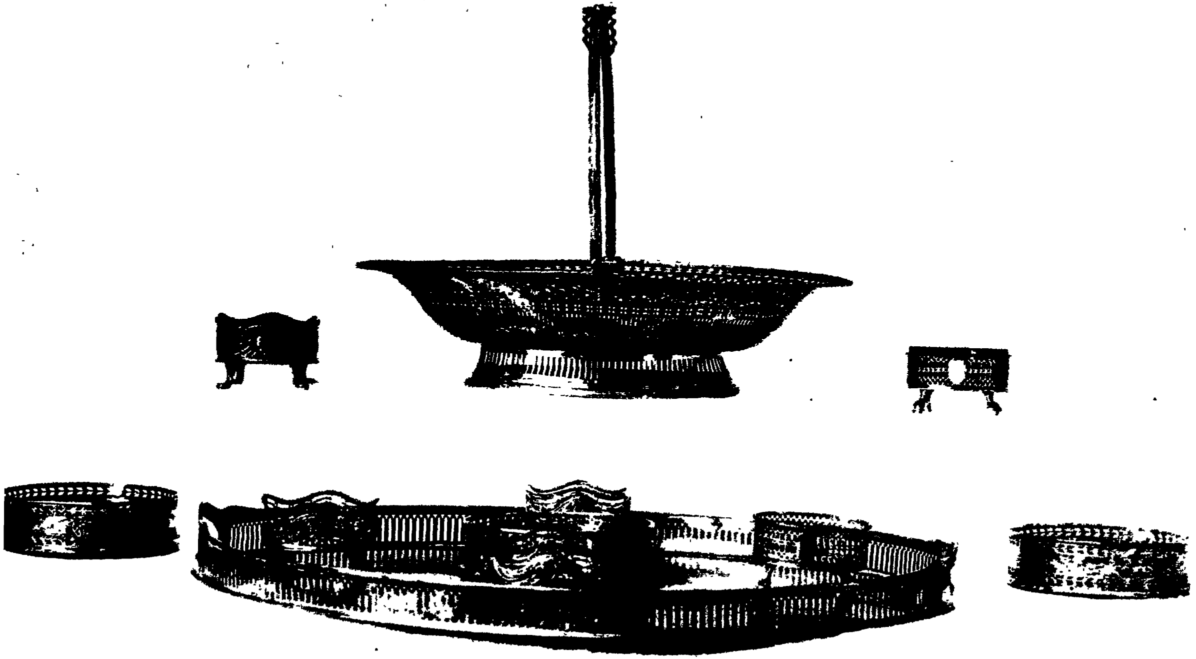
SILVER-PLATED DOUBLE LAMP.

FOR EXPLANATION OF PLATE SEE PAGE 7.



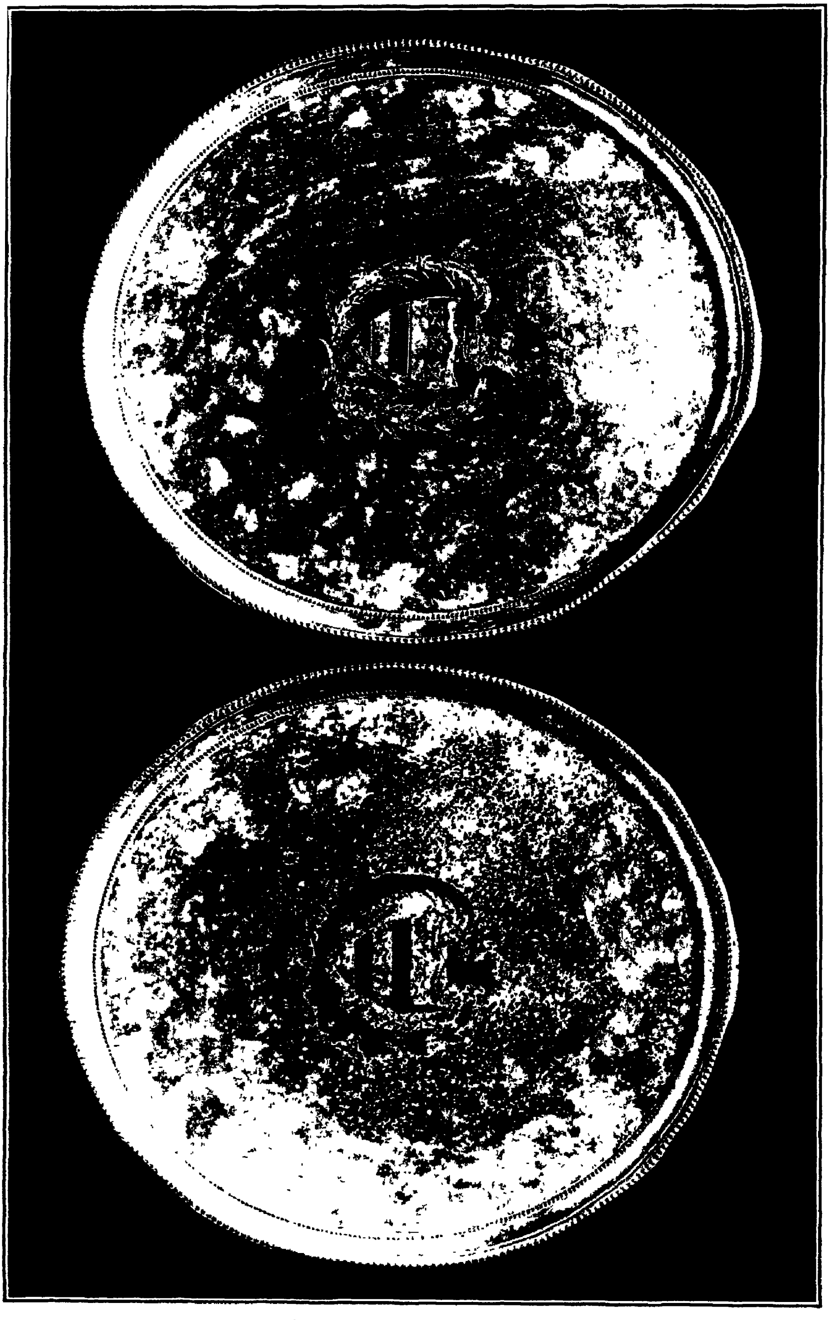
Silver-Plated Knives and Forks.

For explanation of plate see page 8.



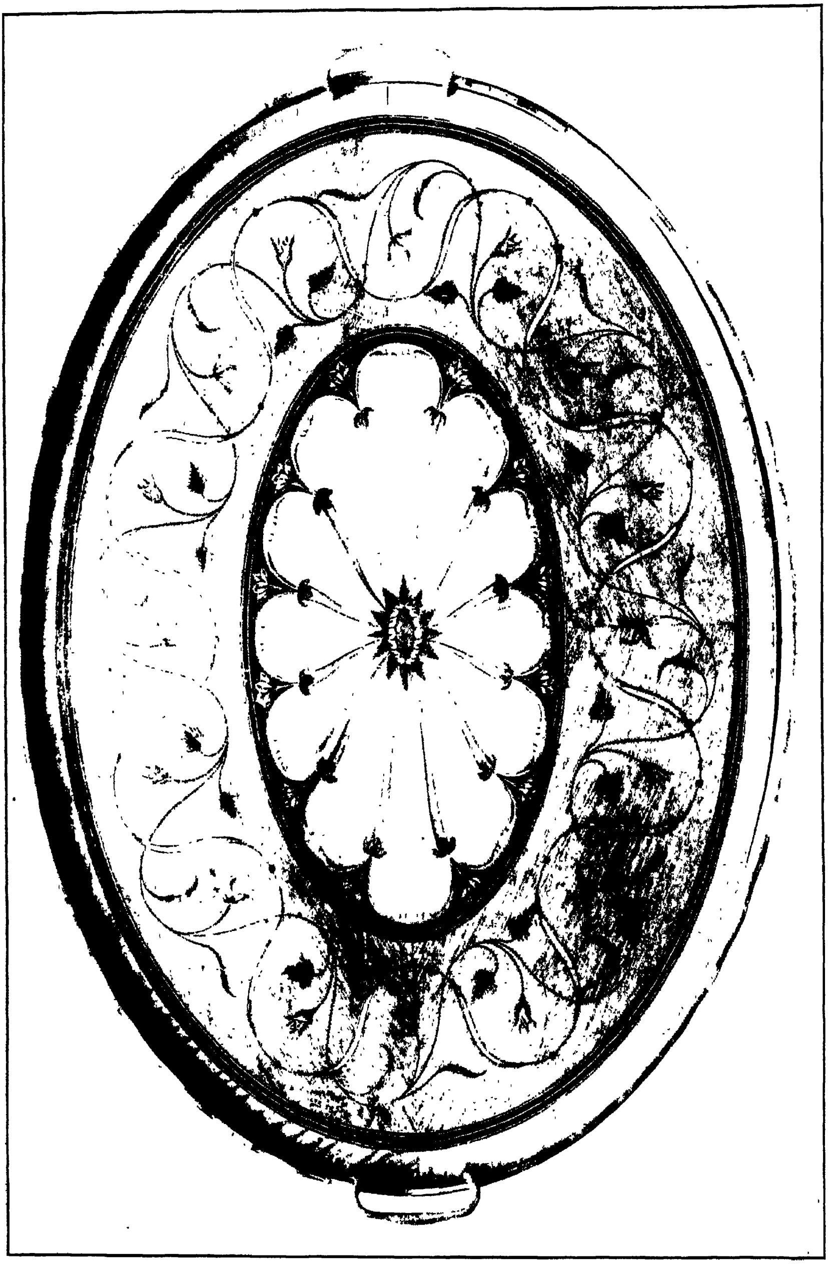
Silver-Plated Tray, Table Coasters, Salt Cellars, and Cake Basket.

For explanation of plate see page 8.



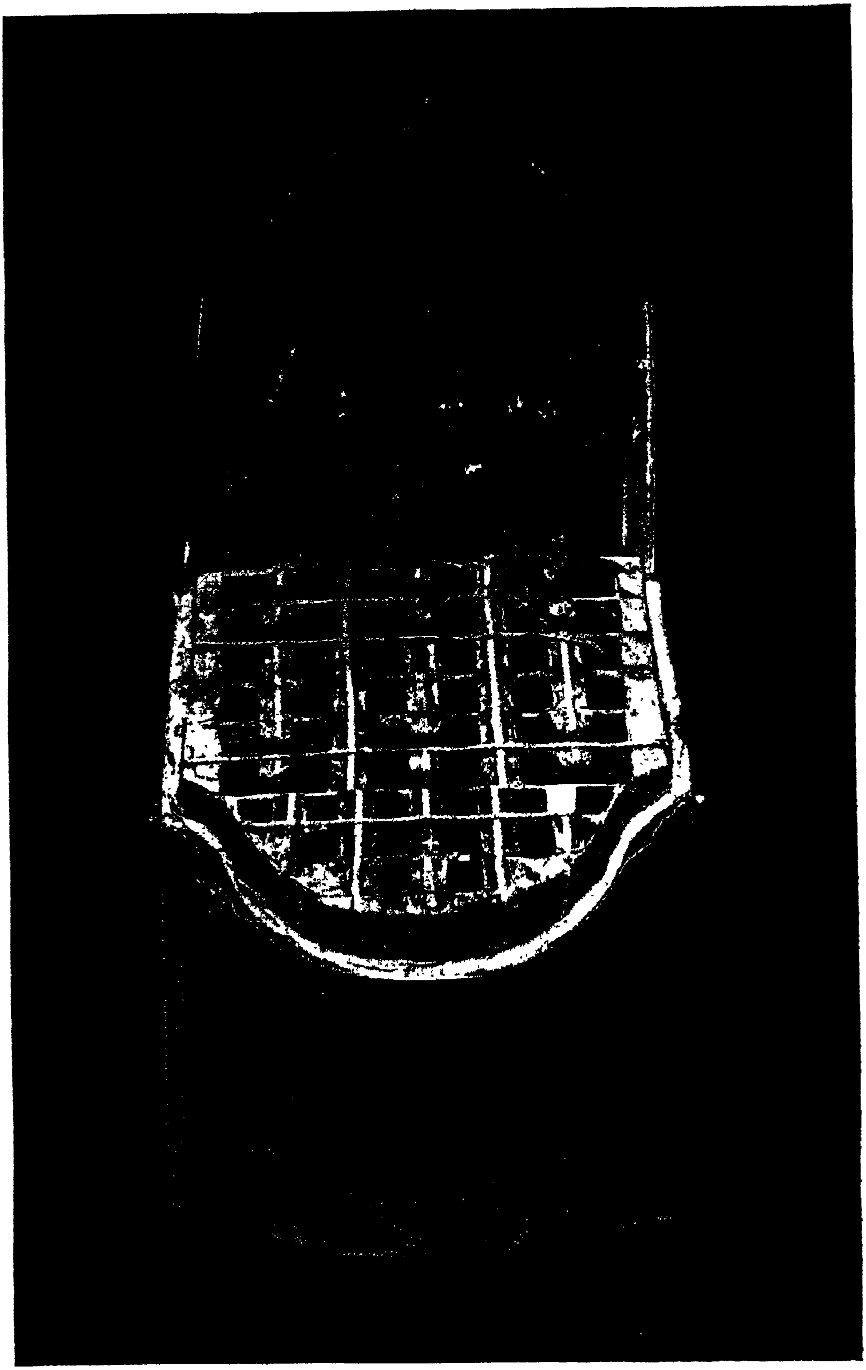
SILVER-PLATED TRAYS.

FOR EXPLANATION OF PLATE SEE PAGE 8.



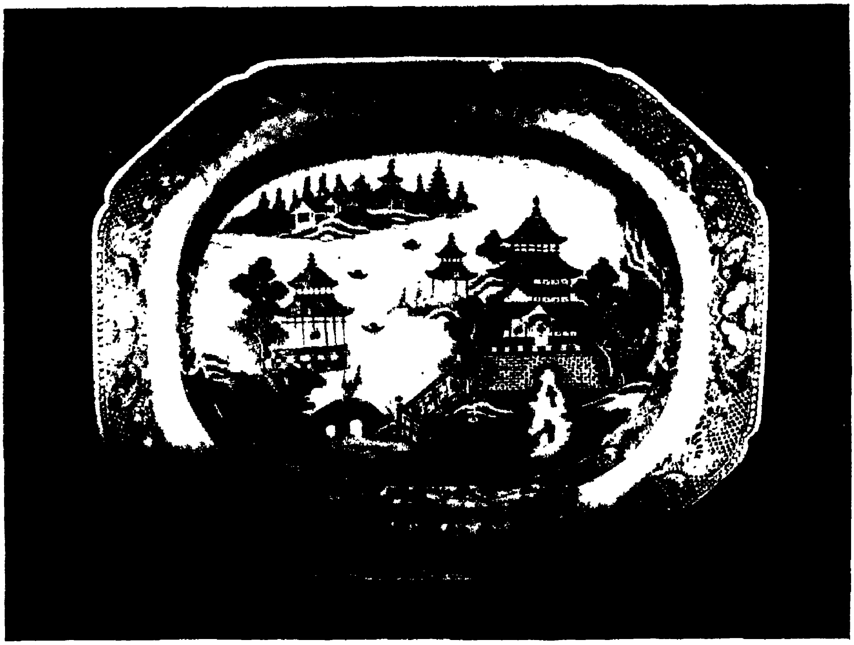
WOODEN TEA TRAY.

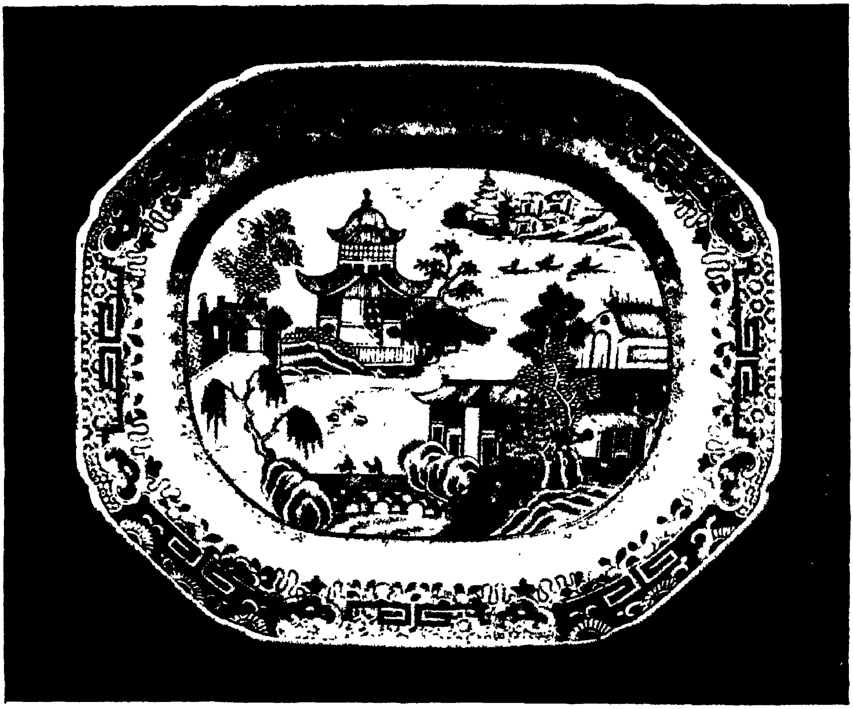
FOR EXPLANATION OF PLATE SEE PAGE 9.



CUTLERY CASE.

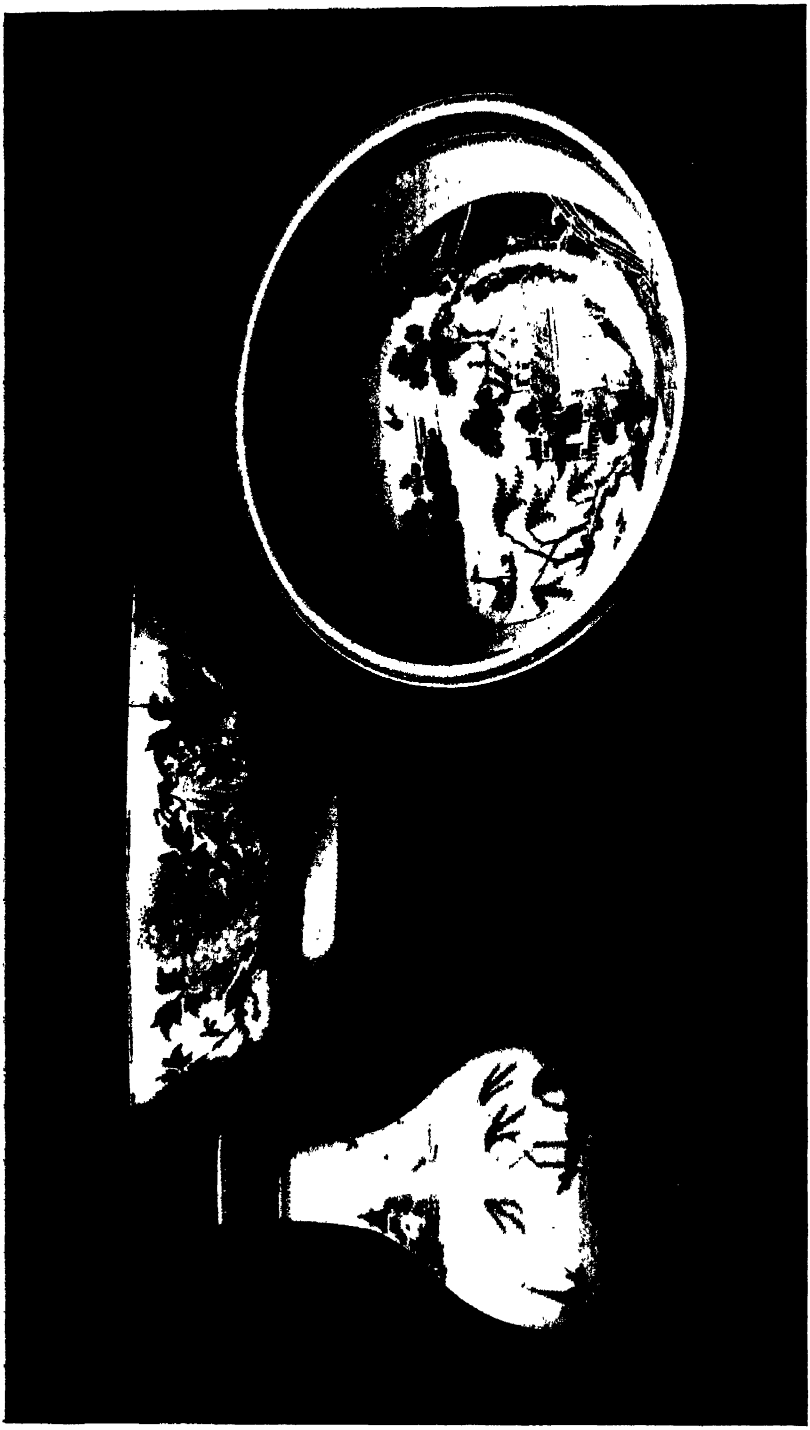
FOR EXPLANATION OF PLATE SEE PAGE 9.





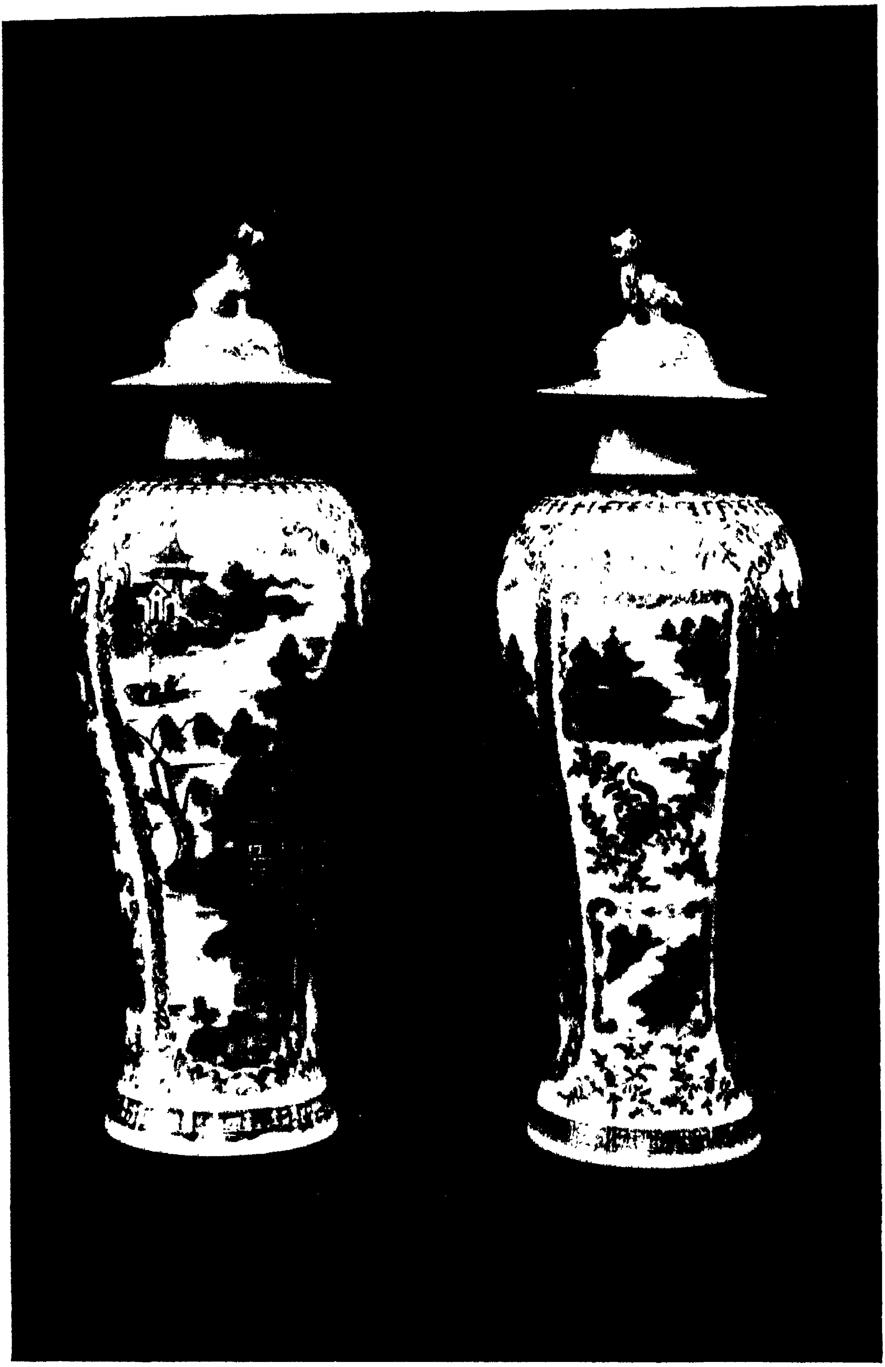
CANTON CHINA PLATTERS.

FOR EXPLANATION OF PLATE SEE PAGE 10.



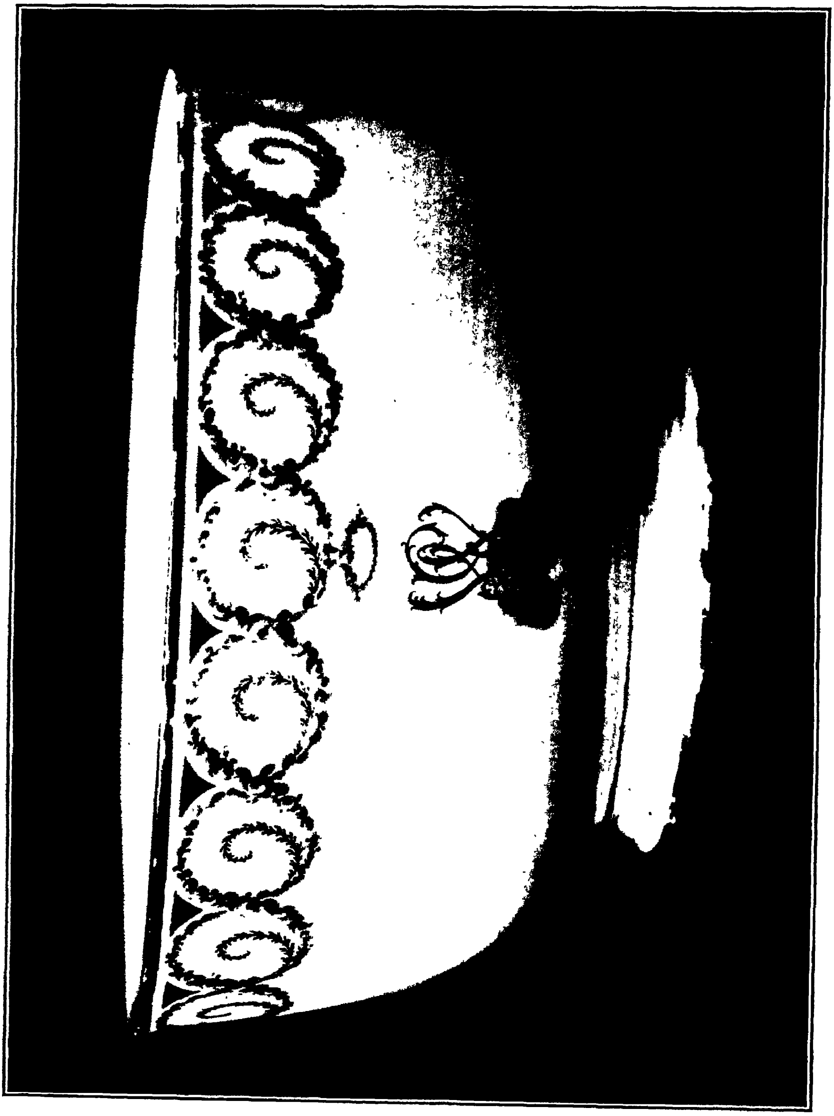
CANTON CHINA BOWLS AND WATER BOTTLE.

FOR EXPLANATION OF PLATE SEE PAGE 10.

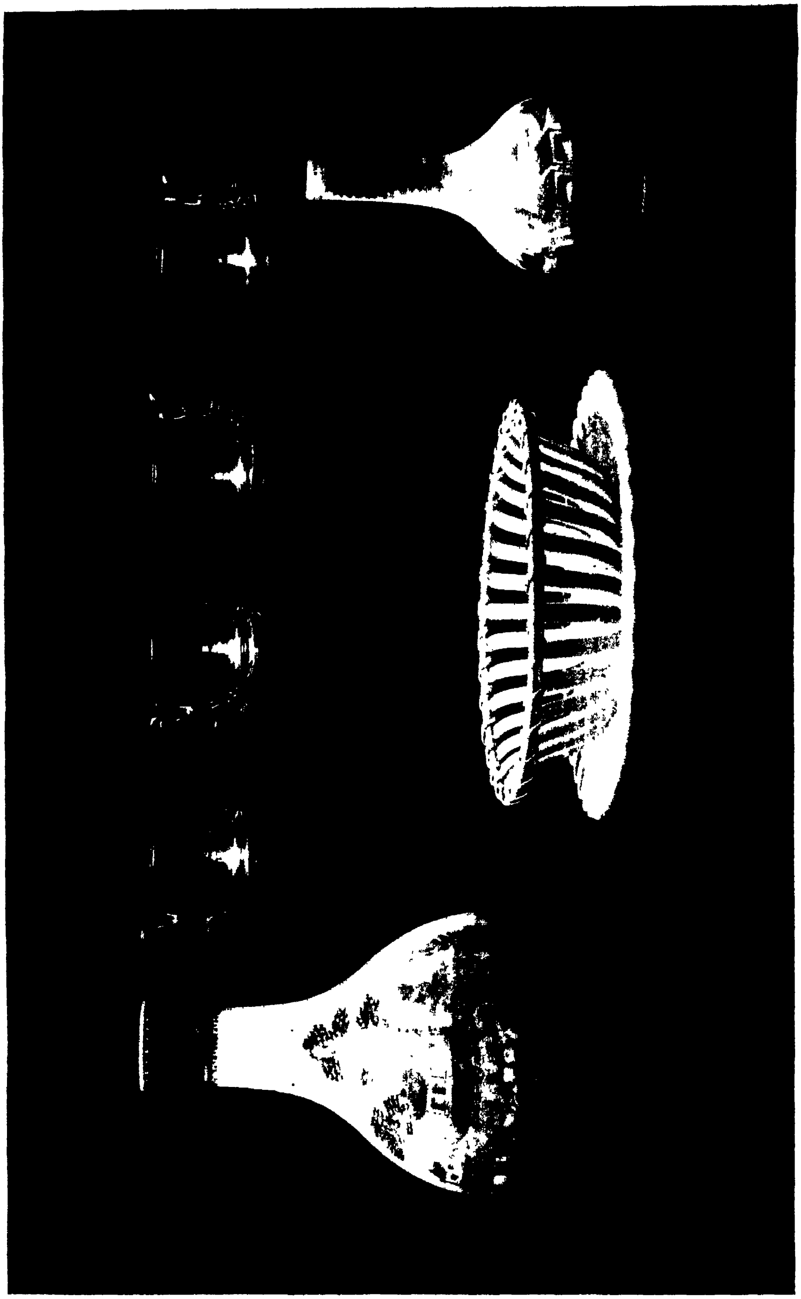


CHINESE VASES.

FOR EXPLANATION OF PLATE SEE PAGE 11.

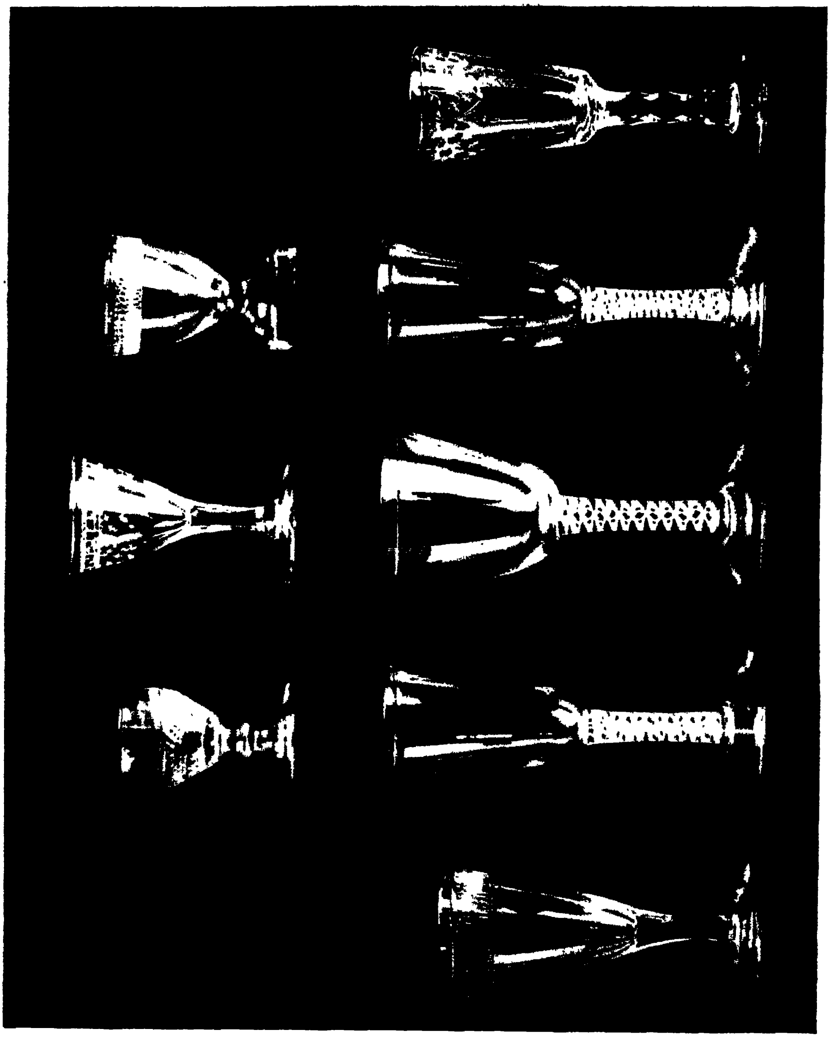


CHINA BOWL.



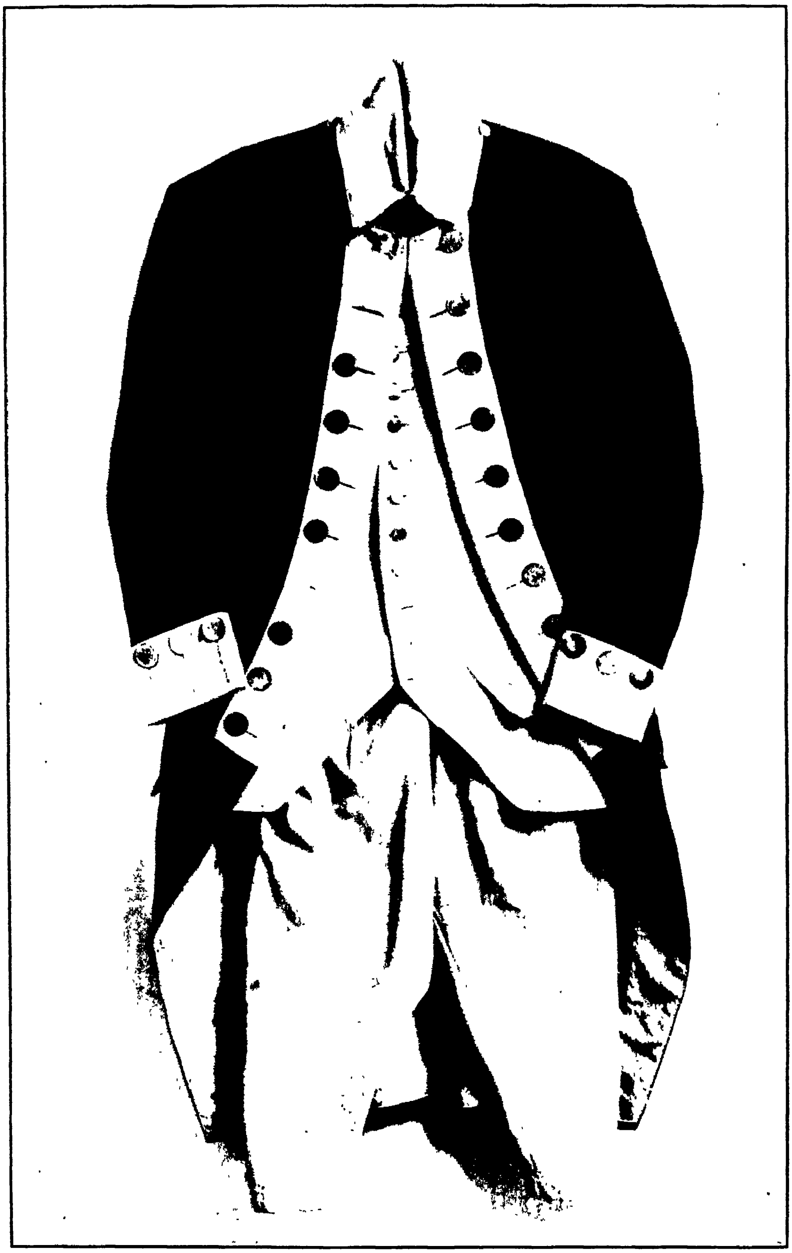
CHINA AND GLASSWARE.

FOR EXPLANATION OF PLATE SEE PAGES 10 AND 11.



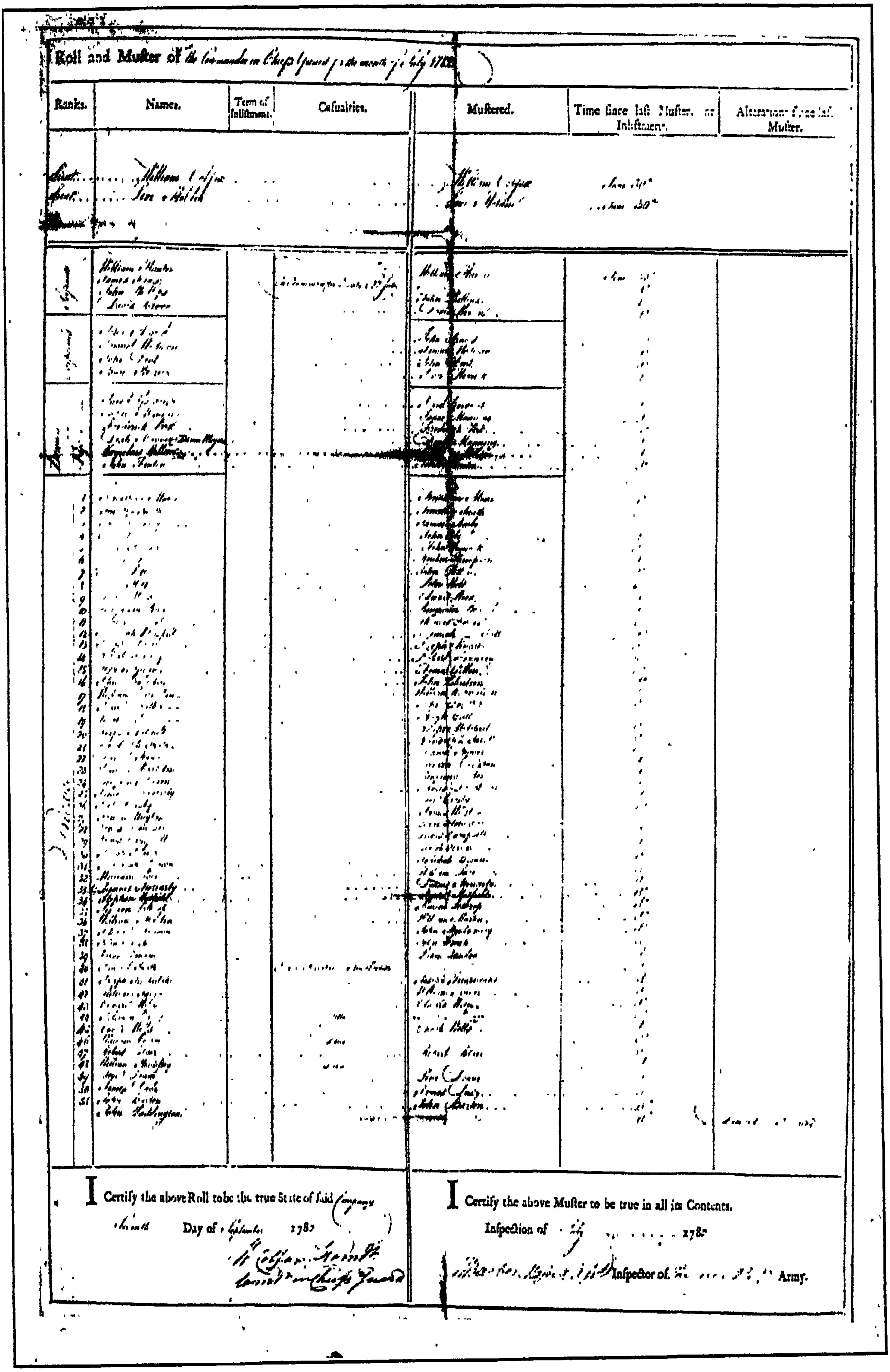
OLD ENGLISH DRINKING GLASSES.

FOR EXPLANATION OF PLATE SEE PAGE 14.



CONTINENTAL ARMY UNIFORM.

FOR EXPLANATION OF PLATE SEE PAGE 14.



Roll and Muster of the Commander in Chiefs Guard for the month of July 1782

Ranks.	Names.	Term of Inlistment.	Casualties.	Mustered.	Time since last Muster, or Inlistment.	Alteration since last Muster.
Lieut.	William Colfax			William Colfax	June 30	
Lieut.	Levi Holden			Levi Holden	June 30	
	William Hunter			William Hunter		
	John Watkins			John Watkins		
	John Fowler					
	Stephen					
	William					
	John Tiddlington			John Burton		

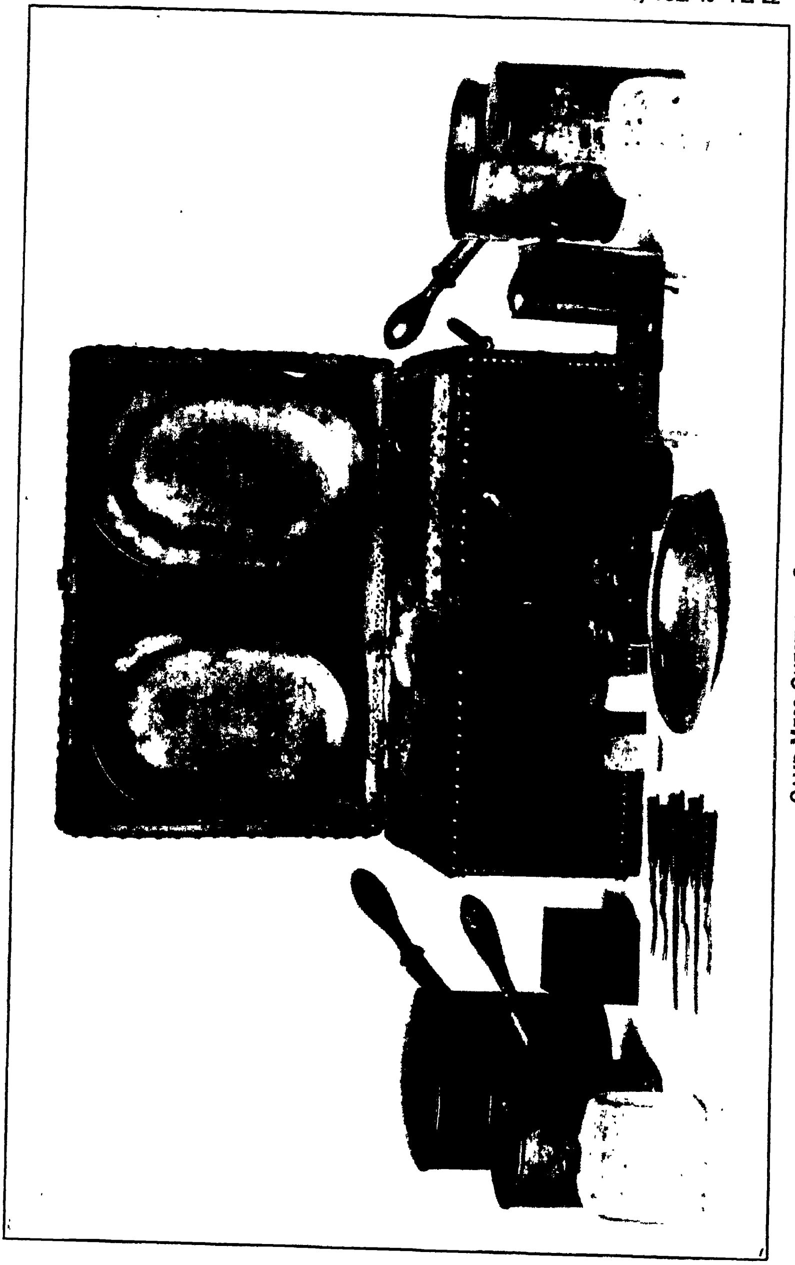
I Certify the above Roll to be the true State of said Company ninth Day of September 1782

W. Colfax Lieut.
Command in Chiefs Guard

I Certify the above Muster to be true in all its Contents.
Inspection of 1782
Inspector of the Army.

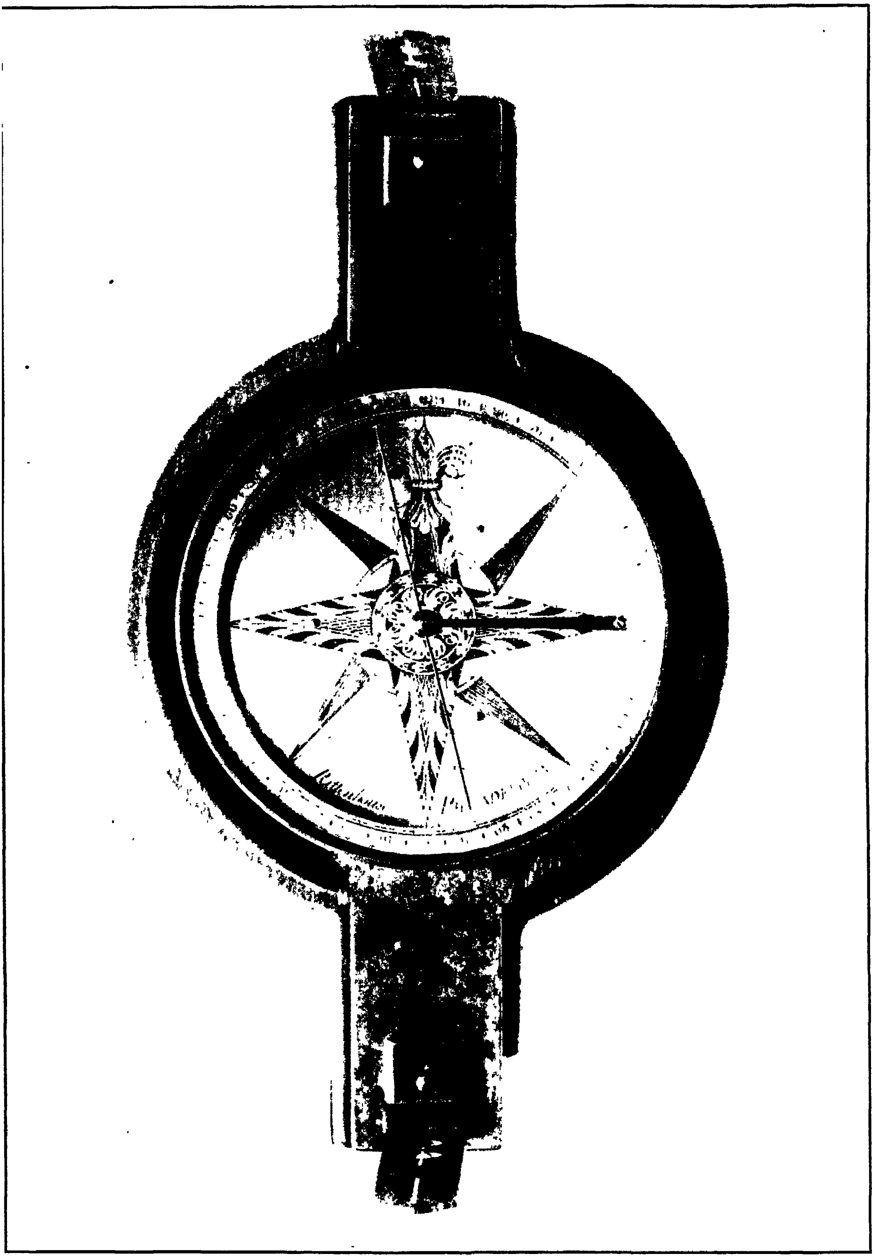
ROLL AND MUSTER OF WASHINGTON'S GUARD, 1782.

FOR EXPLANATION OF PLATE SEE PAGE 16.



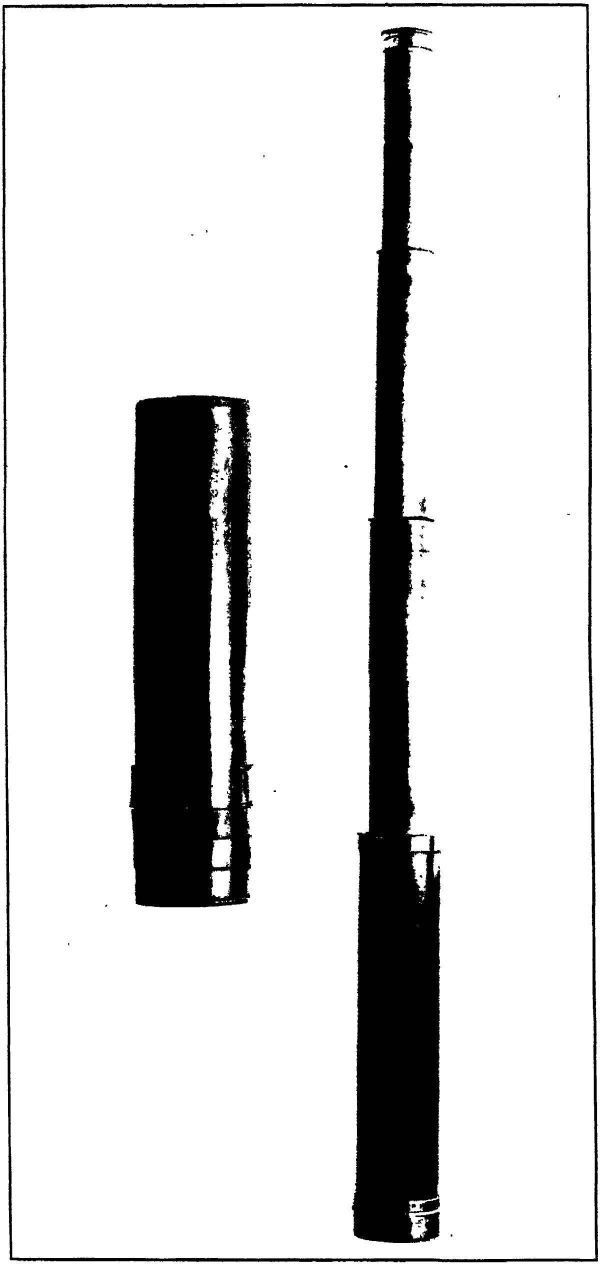
CAMP MESS CHEST AND CONTENTS.

FOR EXPLANATION OF PLATE SEE PAGES 16, 17.



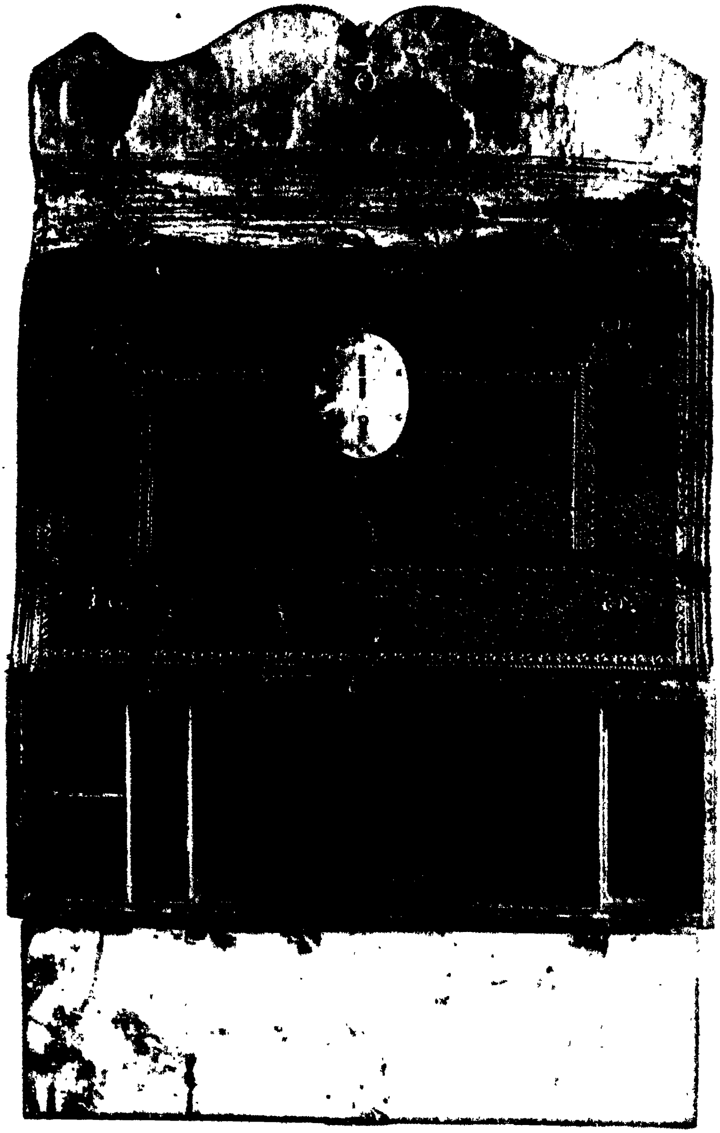
SURVEYOR'S COMPASS.

FOR EXPLANATION OF PLATE SEE PAGE 18.



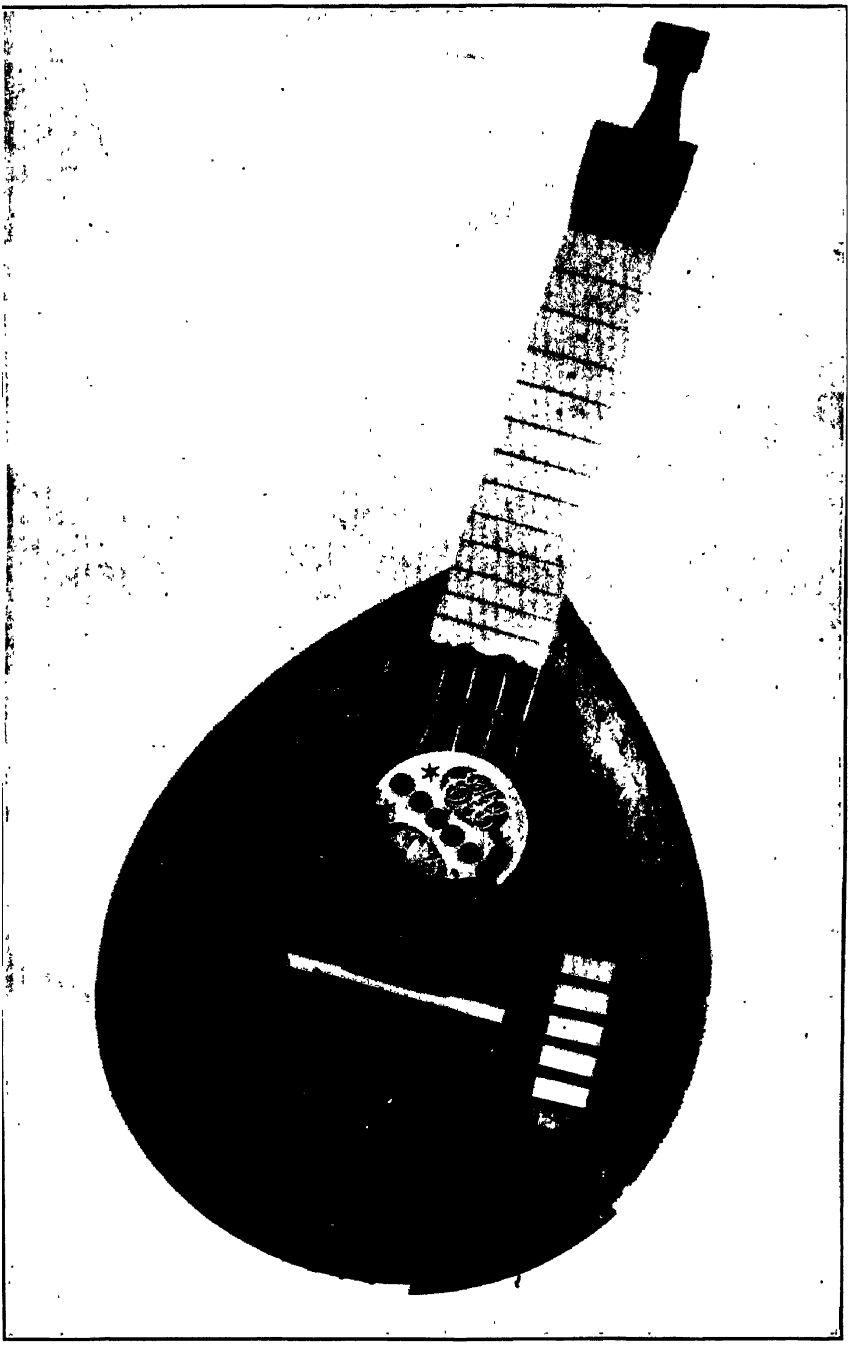
FIELD GLASS AND CASE.

FOR EXPLANATION OF PLATE SEE PAGE 18.



Portable Writing Case.

For explanation of plate see page 18.



ENGLISH KEYED ZITHER PRESENTED BY WASHINGTON TO "NELLY" CUSTIS.

FOR EXPLANATION OF PLATE SEE PAGE 19.

Furniture Owned by Washington at Mount Vernon.

For explanation of plate see pages 4–6.

NOTES ON SOME UNITED STATES GRASSHOPPERS OF THE FAMILY ACRIDIDAE.

By A. N. Caudell,

Of the Bureau of Entomology, United States Department of Agriculture.

Some time ago the United States National Museum received in exchange a pair of *Heliastus minimus* Scudder from the paratypical material in the Museum of Comparative Zoology in Cambridge, Massachusetts. About the same time there was received in exchange from the Snow collection in Kansas a single female specimen from Arizona labeled as this species. On studying this material, and later making further comparisons of material in Cambridge, it was found that Scudder's species was not a true *Heliastus* and that the female received from the Snow collection was not Scudder's species, nor congeneric with it. Thus a new genus is here erected for *Heliastus minimus* and the female received from Snow is described as a new genus and species.

XERACRIS, new genus.

Allied to *Anconia, Heliastus,* and *Ramona* but readily distinguishable from these genera by the metasternal interspace being subquadrate in the female and longer than broad in the male, while in these genera this interspace is at least as broad as long in both sexes, and in the female, broadly transverse. From *Heliastus* and *Ramona* it is also easily separated by having a distinct intercalary vein present on the elytra, in this respect agreeing with *Anconia,* the most nearly allied genus.

Description.—Head moderate, slightly broader than the anterior portion of the pronotum; eyes about as prominent as in *Heliastus,* less prominent than in *Ramona* or typical *Anconia.* Pronotum quite strongly constricted mesially, the anterior portion noticeably narrower than the posterior; lateral carinae not present and the median carina present only as a raised line, barely noticeable except on the posterior lobe, and cut by all three transverse sulci; anterior margin subtruncate, mesially somewhat rounded, the posterior margin obtuse angulate; mesosternal interspace of both sexes transverse but narrower than either of the lobes themselves; meta-

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sternal interspace subquadrate in the female, in the male longer than broad. Elytra extending to or beyond the tips of the hind femora; scapular area in neither sex much expanded, the intercalary vein distinct and bordered on each side with a single row of quadrate cells; the discoidal area is not always closed apically but sometimes continues open to the end of the elytra, or but partly closed. Wings almost entirely hyaline, the tip with a few veins more or less infuscated and the disk with the merest trace of a bluish tinge in some lights. Legs moderately slender, the posterior femora at the widest part scarcely as broad as the head across the eyes; posterior tibiae yellowish with eight spines on the outer margin above, the spines themselves yellow with the apical half black. Cerci simple in both sexes, shorter in the female than in the male; supraanal plate of male scarcely sulcate mesially, the fercula short, quadrate and far separated; subgenital plate of the male apically pointed; valves of the ovipositor short, the upper pair deeply excavate dorsally.

Type.—Heliastus minimus Scudder.

CONIANA, new genus.

In general appearance very similar to the foregoing but readily separable from it by having the metasternal interspace broadly transverse, at least in the female, and by having the apical calcars of the posterior tibiae longer, the outer pair being about twice as long as the terminal dorsal spine.

Type.—Coniana snowi, new species.

The relationship of this and the preceding genus with their allies is shown by the key given on a following page.

CONIANA SNOWI, new species.

One female, Bill Williams Fork, Arizona. F. A. Snow collector.

A small whitish species superficially resembling very closely the *Xeracris minima* of Scudder, but readily separated from that species by the metasternal interspace, which is fully twice as broad as long in this species, while in *minima* it is scarcely longer than broad. The mesosternal interspace is also decidedly broader than in *minima*, being here broader than either of the lobes themselves, the reverse being true of *minima*. A color character also distinguishes these two species, *minima* having the disk of the pronotum posteriorly marked more or less with fuscous and the upper part of the front portion of the lateral lobes blackish, while in the species here characterized these portions are nearly uniformly and very slightly maculate; the surface of the pronotum of this species is also much more roughened and pitted than in *minima*. To the various members of the genus *Anconia* this species is very readily separated by its smaller size and also by the less prominent eyes and the color of the elytra, which is here covered for their entire length with small, clear-cut dark dots on the pale ground color. The wings of the unique type are clear hyaline, and the hind tibiae are very faintly tinged with bluish and bear eight black-tipped spines on the outer margin above; terminal calcars long, the outer pair about twice as long as the adjacent dorsal spine; posterior femora with three or four dark spots above.

Length: Pronotum, 3.5 mm.; elytra, 19 mm.; hind femora, 12 mm.

Type.—In United States National Museum. Cat. No. 18483, U.S.N.M.

This is an interesting little species, and bears such superficial resemblance to *Xeracris minima* as to make its confusion with that insect very likely unless considerable care is exercised.

HELIAULA, new genus.

The author's first acquaintance with *Aulocara rufum* of Scudder was in 1903, when he described specimens from Kansas and Colorado as new under the name *Heliastus guanieri*. Failure to associate it with Scudder's description was due to the fact that its generic characters did not at all indicate relationship to *Aulocara*. Nor is its relationship much nearer, if any, to *Heliastus* than to *Aulocara*. Therefore, at the suggestion of Messrs. Rehn and Hebard, it is removed from both the above genera and for it the new generic name *Heliaula* is here proposed. The following key will serve for the separation of this genus from others allied to *Heliastus*.

Key to the genus Heliastus and allies.

Metasternal interspace broadly transverse in the female, in the male at least as long as broad.
  Elytra with a distinct intercalary vein.
    Calcaria of hind tibiae long, the outer pair about twice as long as the adjacent dorsal spine...*Coniana* Caudell.
    Calcaria of hind tibiae shorter, the outer pair but little longer than the adjacent dorsal spine...*Anconia* Scudder.
  Elytra without a distinct intercalary vein.
    Body and hind femora stout, the latter at its widest part nearly or quite as broad as the head across the eyes.
      Pronotum conspicuously narrowing anteriorly; interocular space narrower than the width of one of the eyes, the scutellum of the vertex with well elevated margins...*Heliastus* Saussure.
      Pronotum quadrate, no narrower anteriorly than posteriorly; interocular space as broad as the width of one of the eyes, the scutellum of the vertex with the margins low...*Heliaula* Caudell.
    Body and hind femora slender, the latter at its widest part scarcely more than one-half as broad as the head across the eyes......................*Ramona* Bruner.
Metasternal interspace quadrate or barely transverse in the female, in the male distinctly longer than broad...*Xeracris* Caudell.

MICROTES NUBILA Scudder.

This species is a synonym of the earlier described *Scirtettica occidentalis* of Bruner. The genus seems amply distinct, and thus the species is to be known as *Microtes occidentalis* Bruner.

THE GENUS ALPHA BRUNNER.

The name *Cordillacris* has been substituted for Brunner's genus *Alpha* by Mr. Rehn[1] on the grounds of preoccupation. In proposing *Cordillacris* Mr. Rehn gives the original reference to *Alpha* as "Smiths. Misc. Coll., XIV, p. 121 (1875)." The volume in this reference should be CCLIV and the page is 117. But the first use of *Alpha*, however, was nearly a quarter of a century earlier when it was used in three different senses by Saussure in his "Etudes Fam. Vesp., vol. ii, p. 167 (1853)," and in the same work, vol. 3, pp. 128, 137, and 160 (1854). But I fail to find that Saussure used this name other than as a division between the species and genus. As such groups or divisional names have no place in nomenclature[2] they do not preoccupy and thus *Alpha* seems to have been available as a generic name when erected in the Orthoptera by Brunner in 1893.

THE GENERIC NAME MACNEILLIA OF SCUDDER.

This generic name was proposed to replace the genus *Pedeticum* of McNeill on the assumption that that name was preoccupied by the generic name *Pedeticus* of Laporte in the Hemiptera. But by the rule of identical spelling *Pedeticus* does not preoccupy *Pedeticum* and thus Scudder's name *Macneillia* was not needed.

AEOLOPLIDES, new genus.

The type species of the genus *Aeoloplus* Scudder is *Caloptenus regalis* by original designation. But *regalis* is now known to be a species of *Melanoplus* and thus *Aeoloplus*, which follows its type species, is a synonym of *Melanoplus*. The species formerly included in *Aeoloplus* are thus left without a generic name, and for them the genus *Aeoloplides* is here proposed, with the *Pezotettix chenopodii* of Bruner as the designated type.

THE GENUS BOOPEDON OF THOMAS.

Key to Species.

1. Principal sulcus of the pronotum not far behind the middle in either sex; males with elytra two or more times as long as the pronotum........................2.
   Principal sulcus of the pronotum, especially in the male, generally much behind the middle; males with elytra less than two times as long as the pronotum....4.

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[1] Can. Ent., vol. 23, 1901, p. 271.

[2] Entomological Code, Par. 90.

2. General color uniformly black or brown, the elytra of both sexes without distinct maculation but the tip darker than the rest; posterior femora uniform in color except for a subbasal annulus...........*nigrum* Thomas. (=*fuscum* Brunner.)
   General color of the male as above but the elytra no darker apically than elsewhere, or with indication of discal maculation, of the female brown or yellowish, the elytra with distinct maculation..3.
3. Male with the posterior femora uniform in coloration, or with a more or less distinct subapical annulus; female with the elytra brown with a yellow stripe near each margin and with a few small yellow spots in the discal field.
   nubilum Say. (=*flavofasciatum* Thomas.)
   Males with the posterior femora twice banded across the outer face besides the subapical annulus; female with the elytra yellowish or brown, no distinct yellow stripe as above and with three or four larger roundish black spots in the discal field, more distinct in individuals with yellowish elytra.
   nubilum, var. *maculata*, new variety.
4. General color testaceous varied with orange, fuscus and black; hind femora conspiculously banded...*auriventris* McNeill.
   General color brownish varied with black above, lighter beneath; hind femora obscurely banded.......................*auriventris*, var. *savannarum* Brunner.

BOOPEDON NUBILUM, var. MACULATA, new variety.

The distinctly banded posterior femora of the male and the distinctive maculation of the elytra of the female will serve for the ready separation of this variety from its allies. The hind tibiae and the ventral surface of the abdomen of the selected type and several of the paratypes are reddish, but in others the tibiae are brownish and abdomen yellowish. In all specimens the hind tibiae are broadly banded with yellowish toward the base. The size is rather large and there seems to be no very great variation to judge from the material before me. The measurements of the selected male type and female allotype are as follows:

Length; pronotum, male, 5.5 mm.; female, 8; elytra, male, 19, female, 11.5; hind femora, male, 19, female, 23.5.

Type.—Male, Victoria, Texas, June. A. N. Caudell, collector. Allotype, same data. Paratypes, one female and 4 males, same data as type and allotype; eight males, Texas, Belfrage coll.; one adult and two immature males, San Antonio, Texas; one male, Columbus, Texas; one male, no locality.

Type and allotype.—In United States National Museum. Cat. No. 18484, U.S.N.M.

The specimen figured in Howard's Insect Book (plate 34, fig. 3) as *B. nubilum* is this variety and shows very nicely the conspicuous banding of the hind femora.

B. nubilum was characterized from the male sex only as is evident from the original description. *B. flavofasciatum* was described from the female only and I consider it the same as *nubilum*. The specimens described by Thomas from southeastern Colorado as *nubilum* of Say are, as shown by comparing his original material in the United

States National Museum with specimens from Arizona, identical with the form described recently by Bruner as *B. fuscum*. Also, from the original description of *B. nigrum* of Thomas and his subsequent quoting of that species in the synonymy of what he took for *nubilum* Say but which was, as shown above, the *B. fuscum* of Bruner, it is evident that this was also the same species and, being the older, should supplant Bruner's name.

MELANOPLUS MUTATUS, new name.

Melanoplus minor of Scudder, described as *Pezotettix minor* in 1875, is a primary homonym of *Pezotettix minor* Walker, an African grasshopper described in 1870.[1] Under all recent codes of nomenclature Scudder's name must fall and for it the new name *Melanoplus mutatus* is here proposed.

MELANOPLUS MARGINATUS Scudder.

Melanoplus marginatus pauper SCUDDER.

The brachypterous specimens of *Melanoplus marginatus* constitute the typical form, being the only ones mentioned in the original description. Scudder's varietal name *pauper* therefore falls as a synonym of the typical name *marginatus*, according to paragraph 31 of Entomological Code. The long-winged form is properly called *amplus*.

MELANOPLUS FEMUR-RUBRUM DeGeer.

Melanoplus coloradus CAUDELL.

Melanoplus coloradus Caudell is but a minor variety of *femur-rubrum*, the only constant differentiating character being the fercula of the male surpassing more or less the mesial interruption of the median sulcus of the supraanal plate. This character is of scarcely sufficient value to hold a name, and this species is therefore sunk as a synonym of *femur-rubrum*.

MELANOPLUS DEVASTATOR Scudder.

Melanoplus devastator typicalis SCUDDER.

This varietal name should be dropped and the name *devastator* alone used according to paragraph 31 of the Entomological Code.

MELANOPLUS DEVASTATOR Scudder.

Melanoplus devastator affinis SCUDDER.

The name *affinis* as here used is invalidated by the earlier use as a specific name by the same author. Paragraph 37 of Entomological Code applies here. But the characters separating this variety from the typical form are of such minor importance that the name may well be sunk into synonymy under *devastator*, as it scarcely deserves a new name being proposed for it.

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[1] Cat. Derm. Salt. Brit. Mus., vol. 4, 1870, p. 699.

MELANOPLUS DIMINUTUS Scudder.

Melanoplus consanguineus SCUDDER.

Melanoplus consanguineus as suggested by its author in the original description, is not distinct from the *diminutus* of the same author. It should therefore fall into synonymy under that species.

MELANOPLUS DEVASTATOR Scudder.

Melanoplus virgatus SCUDDER.

Melanoplus virgatus is a synonym of *Melanoplus devastator*, no constant differentiating characters separating it from that species.

THE RECENT AND FOSSIL MOLLUSKS OF THE GENUS RISSOINA FROM THE WEST COAST OF AMERICA.

By Paul Bartsch,

Curator, Division of Marine Invertebrates, United States National Museum.

INTRODUCTION.

It is interesting to note that the first species recorded from West American waters served also as the type of the world-wide distributed genus now under discussion. The noted traveler and naturalist, Chevalier Alcide D'Orbigny, in his Voyage dans L'Amerique Meridionale, which extended over the years 1826–1833, collected a wonderful lot of material and among other things a Rissoid, on the coasts of Bolivia and Peru, for which he erected the genus *Rissoina* [1] and which he christened *Rissoina inca.*[1]

Ten years later Dr. Karl Theodor Menke, in a paper, Conchylien von Mazatlan mit kritischen Anmerkungen, based on a large collection made in part by Heinrich Melcher, of Bremen, who spent several years at Mazatlan, and partly by an unnamed collector from whom Doctor Menke purchased a box of shells, also from Mazatlan, described *Rissoa stricta* [2] from that place. This is a true *Rissoina.*

Two years after this, Dr. F. H. Troschel, in his Verzeichniss der durch Herrn Dr. v. Tschudi in Peru gesammelten Conchylien, described *Rissoina sulcifera* [3] from Peru. This mollusk is not congeneric with *Rissoina* but must be referred to the Rissoid genus *Iravidia* of Blanford.

The same year Prof. C. B. Adams, of Amherst College, Massachusetts, published his Catalogue of Shells Collected at Panama.[4] In this paper, which details the result of one of the most wonderful records of intensive collecting, we learn that during the period between November 25, 1850, and January 3, 1851—that is, 40 days—Professor Adams collected and kept data upon no less than 41,830 specimens of mollusks. It is equally interesting to note that although the cases containing the specimens did not arrive until

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[1] Voyage Amer. Merid., p. 395, 1840, pl. 53, figs. 11-16.

[2] Zeitschr. Malak., vol. 7, 1850, pp. 177-178.

[3] Wieg. Archiv. Naturg., vol. 1, 1852, pp. 154-155.

[4] Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, pp. 229-549.

PROCEEDINGS U. S. NATIONAL MUSEUM, VOL. 49—NO. 2094.

August 14, 1851, the first part of the catalogue appeared in June, 1852, and the last part of the report upon the 516 species was printed in July of the same year, 11 months after the arrival of the collection at Amherst.

In this paper Professor Adams describes the following species under the genus *Rissoa* which belong to *Rissoina:*

Rissoa clandestina, p. 401.
Rissoa firmata, p. 401.
Rissoa fortis, p. 402.
Rissoa janus, p. 403.
Rissoa scalariformis, p. 404.

The last is a young specimen of *Rissoina firmata.* Here also the following shells are described as *Rissoa:*

Rissoa infrequens, p. 403, which is a *Pliciscala.*
Rissoa notabilis, p. 404, which is an *Odostomia.*
Rissoa inconspicua, p. 402, which is also an *Odostomia.*

Later Dr. Philip P. Carpenter reported upon a collection of shells made during 1848–1850 by Frederick Reigen, a Belgian gentleman, at Mazatlan. His report, Catalogue of the Collection of Mazatlan Shells in the British Museum, was published in parts during the years 1855–1857, the part dealing with our genus appearing in 1856.

Only two species are mentioned:

Rissoina stricta Menke, and
Rissoina woodwardii Carpenter,

the last being new.[1]

In 1860 O. A. L. Mörch, in his Beiträge zur Molluskenfauna Central Amerikas, a paper based upon shells collected by Dr. A. S. Oersted, lists the following members of the genus *Rissoina:*[2]

Rissoina woodwardi Carpenter, from Puntarenas.
Rissoina inca D'Orbigny, from Sonsonate.
Rissoina scalariformis, C. B. Adams, no specific locality mentioned.
Rissoina effusa Mörch, no specific locality mentioned.
Rissoina contabulata Mörch, Sonsonate.

The last two being additions to the Rissoina fauna of the West Coast of America.

In 1864 Dr. Philip P. Carpenter briefly described *Rissoina interfossa* on page 656 of his Supplementary Report on the Present State of our Knowledge with Regard to the Mollusca of the West Coast of America.[3] This he diagnosed more fully two years later on page 217 of his paper, Descriptions of New Marine Shells from the Coast of California.[4] This species has since been referred to the genus *Bit-*

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[1] Cat. Mazat. Shells, 1856, p. 357.
[2] Malāk. Blät., vol. 7, 1860, pp. 67–78.
[3] Rept. Brit. Ass. Adv. Sci. for 1863.
[4] Proc. Cal. Acad. Nat. Sci., 1866, vol. 3.

tium; by Bartsch, in The Recent and Fossil Mollusks of the Genus Bittium from the West Coast of America, page 401.[1]

In the preceding year Doctor Carpenter described *Rissoina expansa* from Mazatlan, in his paper on Diagnosis of New Forms of Mollusca Collected by Col. E. Jewett on the West Tropical Shores of North America.[2]

The next paper dealing with members of this genus was published by L. DeFolin as Les Meleagrinicoles Especes Nouvelles (Havre, 1867). This deals with mollusks obtained from the burrows in pearl oyster shells, which came from the vicinity of Negritos, (does this mean Negros, P. I.?) and iles aux Perles (=Margarita Island), Bay of Panama. In this paper *Rissoa zeltneri* is described on pages 47–48 and figured on plate 5, figure 1, and *Rissoa insignis* on pages 48–49, figured on plate 5, figures 2 and 3.

The last species was made the type of the genus *Folinia* by H. Crosse in his review of DeFolin's paper.[3] Unfortunately, the name *Rissoa insignis* DeFolin is preoccupied by *Rissoa insignis* Adams and Reeve, 1850, which makes the new name given in our text necessary. We do not deem it of generic rank and shall consider *Folinia* a subgenus of the present group.

In 1870 DeFolin published *Rissoa laurae*,[4] which must be referred here.

No additions were made until 1897, when Dr. William Healey Dall, in his Notice of Some New or Interesting Species of Shells from British Columbia and the Adjacent Region, published *Rissoina newcombi*[5] from Cumshewa Inlet. This, to date, forms the northernmost record for the distribution of the genus on the west coast of America.

In 1902 the author described A New Rissoina from California,[6] calling it *Rissoina bakeri.*

In the same year Doctor Dall and the present writer described A New Rissoina from California,[7] under the name of *Rissoa kelseyi.*

The last paper dealing with West American members of this genus was published by Doctor Dall as Two Undescribed Californian Shells,[8] in which he described *Alaba oldroydi,* which must be considered as a synonym of *Rissoina kelseyi* Dall and Bartsch. This species has *Alabaid* sculpture, but has the clawed operculum of *Rissoina,* a fact unknown when Doctor Dall described it, as all the specimens available at the time were without opercula. That he was in doubt about its generic position is shown by the statement following the description: "None of the specimens retains its operculum. The form of the shell, and especially of the aperture, recalls *Rissoina*, but the irregular varices, sculpture, and apex are more like *Alaba*. A certain amount of doubt as to its true zoological position must remain until the operculum is known."

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[1] Proc. U. S. Nat. Mus., vol. 40, 1911.

[2] Ann. Mag. Nat. Hist., ser. 3, vol. 15, 1865, p. 399.

[3] Journ. de Conch., vol. 16, 1866, p. 218.

[4] Fonds de la Mer., vol. 1, 1870, pp. 262–263.

[5] Bull. Nat. Hist. Soc. Brit. Col., No. 2, 1897, p. 14.

[6] Nautilus, vol. 16, p. 9.

[7] Idem, vol. 16, p. 94.

[8] Idem, vol. 19, 1905, p. 15.

I wish to express my extreme indebtedness to the Board of Trustees of Amherst College, and particularly to Prof. F. B. Loomis, through whose kind offices it was possible for me to have Prof. C. B. Adams' types of the Panama species for study, comparison and figuring. I am also indebted to Mr. Adolph Jensen, of the Zoological Museum of Copenhagen, for the loan of O. A. L. Mörch's types of his Central American forms.

The illustrations accompanying this report, with few exceptions, are from enlarged photographs made direct from specimens by Mr. T. W. Smillie, of the United States National Museum, and were retouched by Mrs. E. B. Decker. The exceptions are:

Carpenter's *Rissoina woodwardii*, of which I have not seen specimens, and of which I give camera lucida figures by Doctor Carpenter.

Of *Rissoina signae*, new name, *Rissoa insigne* DeFolin, *Rissoina laurae* DeFolin and *Rissoina zeltneri* DeFolin—I give figures copied from DeFolin's works because I have been unable to obtain specimens of these species.

ANALYTICAL KEYS.

KEY TO THE SUBGENERA OF THE WEST AMERICAN RISSOINAS.

Posterior angle of the aperture simple.......................*Rissoina*, pp. 38–61.
Posterior angle of the aperture almost constricted off into a separate opening by a projection from the parietal wall, and another apposing from the outer lip..................*Folinia*, p. 61.

KEY TO SPECIES OF WEST AMERICAN RISSOINAS.

a^1. Spiral sculpture present.
  b^1. Spiral sculpture on spire and base.
    c^1. Axial sculpture consisting of prominent ribs.
      d^1. Axial ribs acutely sublamellar; intercostal spaces with cloth-like textured sculpture.
        e^1. Adult shell about 5 mm. long...........................*firmata*, p. 38.
        e^2. Adult shell about 3 mm. long.............................*excolpa*, p. 39.
      d^2. Axial ribs not acutely sublamellar; intercostal spaces without cloth-like textured sculpture.
        e^1. Summit of whorls strongly shouldered.
          f^1. Base evenly curved; without a tumid area or keel on the anterior third.
            g^1. Shell broadly conic.
              h^1. Basal sculpture uniform.
                i^1. Intercostal spaces about as wide as the ribs.
                  j^1. Basal cords 15, adult more than 8.5 mm.........*stricta*, p. 39.
                  j^2. Basal cords 13, adult not more than 7.5 mm......*fortis*, p. 40.

i^2. Intercostal spaces double the width of the ribs.
j^1. Basal cords 11 .... *gisna*, p. 41.
j^2. Basal cords more than 15 .... *inca*, p. 42.
h^2. Basal sculpture not uniform, consisting of strong spiral cords and fine lines between them..... *favilla*, p. 43.
g^2. Shell not broadly conic but elongate conic.
h^1. Spiral sculpture of the spire exceedingly fine... *mazatlanica*, p. 43,
h^2. Spiral sculpture of the spire strong .... *helena*, p. 44.
f^2. Base not evenly curved, with a decidedly tumid area or keel anteriorly.
g^1. Base with a tumid area on the anterior third.
h^1. Adult shell 9 mm. long .... *io*, p.44.
h^2. Adult shell 7 mm. long .... *dina*, p. 45.
g^2. Base with a strong keel at the insertion of the columella .... *signae*, p. 61.
e^2. Summit of the whorl not strongly shouldered but appressed.
f^1. Shell elongate-ovate .... *expansa*, p. 46.
f^2. Shell not elongate-ovate.
g^1. Shell elongate-conic.
h^1. Axial ribs less than 32.
i^1. Last whorl inflated .... *peninsularis*, p. 46.
i^2. Last whorl not inflated .... *adamsi*, p. 47.
h^2. Axial ribs more than 42 .... *townsendii*, p. 48.
g^2. Shell not elongate-conic but broadly conic .... *barthelowi*, p. 48.
c^2. Axial sculpture not consisting of prominent ribs; ribs obsolete.
d^1. Whorls shouldered .... *kelseyi*, p. 49.
d^2. Whorls not shouldered but overhanging .... *lapazana*, p. 50.
b^2. Spiral sculpture on base only.
c^1. Axial ribs present.
d^1. Base with two keels .... *contabulata*, p. 51.
d^2. Base with one keel and two incised spiral lines .... *histia*, p. 51.
d^3. Base with many spiral cords .... *zeltneri*, p. 52.
c^2. Axial ribs absent .... *laurae*, p. 52.
a^2. Spiral sculpture absent.
b^1. Axial sculpture consisting of strong ribs.
c^1. Axial sculpture consisting of strong ribs only.
d^1. Summit of the whorls shouldered.
e^1. Axial ribs lamellar .... *burragei*, p. 52.
e^2. Axial ribs not lamellar .... *nereina*, p. 53.
d^2. Summit of the whorls not shouldered.
e^1. Whorls decidedly constricted immediately anterior to the summit .... *effusa*, p. 54.
e^2. Whorls not or scarcely at all constricted anterior to the summit.
f^1 Adult shell more than 4.5 mm. long .... *pleistocena*, p. 54.
f^2. Adult shell 3 mm. or less.
g^1. Anterior portion of base bordered by a fasciole.... *californica*, p. 55.
g^2. Anterior portion of base without fasciole.
h^1. Axial ribs on last whorl 20 .... *clandestina*, p. 55.
h^2. Axial ribs on last whorl 16 .... *mexicana*, p. 56.

- c^2. Axial sculpture not consisting of ribs only.
  - d^1. Axial sculpture consisting of ribs and fine raised threads between them.
    - e^1. Whorls decidedly inflated .... *bakeri*, p. 56.
    - e^2. Whorls not inflated.
      - f^1. Axial threads between the ribs fine............... *woodwardii*, p. 57.
      - f^2. Axial threads between the ribs coarse .... *newcombii*, p. 58.
  - d^2. Axial sculpture consisting of ribs but no fine threads between them; sculpture between the ribs consisting of irregular crinkly markings .... *cleo*, p. 58.
- b^2. Axial sculpture consisting of obsolete ribs.
  - c^1. Shell elongate-ovate.................................... *cerrosensis*, p. 59.
  - c^2. Shell not elongate-ovate but elongate-conic.
    - d^1. Shell slender, ribs faint, adult shell 2.8 mm.......... *dalli*, p. 59.
    - d^2. Shell stout; ribs more strongly developed, adult shell 3.5 mm .... *coronadoensis*, p. 60.

DESCRIPTION OF SPECIES.

RISSOINA FIRMATA C. B. Adams.

Plate 32, figs. 4, 6.

Rissoa firmata C. B. ADAMS, Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, p. 401.
Rissoa scalariformis C. B. ADAMS, Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, p. 402.

Shell of medium size, white, semitranslucent. Nuclear whorls decollated, a portion of the last turn only remaining. The succeeding turns are well rounded, decidedly appressed at the summit with somewhat of a shoulder, which extends over the posterior third of the spaces between the sutures. The whorls are marked with exceedingly strong, decidedly protractively curved sublamellar axial ribs, which are somewhat irregularly spaced. Twelve of the ribs occur upon the first and 14 upon the remaining turns. The intercostal spaces are at least four times as broad as the ribs and are crossed by very slender, closely spaced, quite evenly developed spiral threads, which pass up on the sides of the ribs, but do not appear to cross their summit. Of these spiral threads, about 40 occur between the sutures on the antepenultimate turn. Sutures well impressed, rendered sinuous by the strong ribs. Periphery well rounded. Base moderately long, marked by the strong continuation of the axial ribs, which extends to the umbilical space, intercostal spaces sculptured, like those of the spire. Aperture moderately large, broadly oval; posterior angle neither acute nor obtuse; outer lip very thick at the edge. Columella short, very stout, curved, reflected over and appressed to the base as a thick callus; parietal wall covered with a thick callus, which fuses with the outer lip and the columella.

Professor Adams's type was found in sand at Panama. It has 7 postnuclear whorls and measures: Length, 4.7 mm.; diameter, 2 mm.

Professor Adams's *Rissoa scalariformis*, of which he collected a single specimen at Panama, proves to be the young of the present species. It lacks the strong basal callus resulting from the reflection of the columella, and also the thickened lip. See plate 32, fig. 4.

Professor Adams's shells are at Amherst College, Massachusetts. The United States National Museum contains three lots of this species: Cat. No. 4163, 1 specimen from the Cape of San Lucas; Cat. No. 46151, 3 specimens from the Gulf of California, and Cat. No. 222865, 3 specimens from Cape Pulmo, Gulf of California.

RISSOINA EXCOLPA, new species.

Plate 30, fig. 2.

Shell elongate-conic, semitransparent, bluish white. Nuclear whorls decollated, except the last turn, which is smooth. Postnuclear whorls moderately well rounded, appressed at the summit—which creeps up on the preceding whorl—marked by sublamellar, somewhat sinuous, protractive, axial ribs, which are about one-third as wide as the spaces that separate them and form continuous lines from whorl to whorl. Of these ribs, 12 occur upon the first and 14 upon each of the remaining turns. In addition to the axial ribs, the whorls are marked in the intercostal spaces by exceedingly fine lines of growth which, combined with the spiral sculpture, lend the surface of the shell a very minutely reticulated appearance. The spiral sculpture consists of numerous, fine, spiral lirations, which are about as wide as the spaces that separate them. Of these lirations, 28 occur between the sutures on the penultimate turn. Suture moderately constricted. Periphery of the last whorl well rounded. Base somewhat produced anteriorly, well rounded, marked by the strong continuations of the axial ribs which extend to the anterior end of the shell, the spiral sculpture of the base being in every way similar to that on the spire. Aperture irregularly oval; posterior angle acute; outer lip thick, reinforced by a strong varix; columella short, stout, strongly curved and decidedly reflected over and adnate to the base; parietal wall covered with a thick callus, which renders the peritreme complete.

The type and two other specimens, Cat. No. 46155, U.S.N.M., come from the Gulf of California. The type has 5½ post-nuclear whorls and measures: Length, 4.1 mm.; diameter, 1.8 mm. Cat. No. 23748, U.S.N.M., contains 2 additional specimens from the Gulf of California.

RISSOINA STRICTA Menke.

Plate 28, fig. 6.

Rissoina stricta Menke, Zeit. f. Malak., 1850, p. 177, No. 37.

Shell large, elongate-conic, bluish white. Nuclear whorls at least 2, well rounded, smooth, forming a well elevated helicoid spire. Postnuclear whorls flattened, weakly shouldered at the summit, marked by strong, slightly curved, decidedly protractive axial ribs of which

12 occur upon the first, 14 upon the second, 16 upon the third, 18 upon the fourth, 20 upon the fifth, 22 upon the sixth, 26 upon the seventh, and 28 upon the penultimate whorl. These ribs extend prominently to the summit and render the sutures crenulated. Intercostal spaces almost as wide as the ribs, crossed between the sutures by numerous very fine, closely spaced, spiral striations. Base of the last whorl moderately long, well rounded, marked by the continuations of the axial ribs which extend undiminished to the umbilical chink and by 15 equal, and equally spaced, slender, spiral threads which extend prominently across the intercostal spaces and weakly over the ribs. Aperture small, very oblique, channeled anteriorly and posteriorly; outer lip very thick, reinforced immediately behind the edge by a strong varix; inner lip moderately thick, appressed to the base, sinuous, the anterior portion so arranged as to give the aperture the aspect of having a truncated columella.

Cat. No. 4062, U.S.N.M., contains 3 specimens from Cape San Lucas, 1 of which has served for our description and figure. This has lost the first 1½ nuclear whorls, retaining only 1 of them. It has 9 postnuclear whorls and measures: Length, 8.7 mm.; diameter, 3.3 mm.

The following specimens are in the collection of the United States National Museum:

Cat. No. 4062, Cape San Lucas, Lower California, 3 specimens; Cat. No. 34209, La Paz, Lower California, 4 specimens; Cat. No. 46153, Gulf of California, 2 specimens; Cat. No. 46157, Gulf of California, 2 specimens; Cat. No. 46163, Mulege Bay, Lower California, 2 specimens; Cat. No. 46168, Gulf of California, 1 specimen; Cat. No. 76269, Mazatlan, Mexico, 1 specimen; Cat. No. 195370, St. Margarita Island, Lower California, 1 specimen; Cat. No. 222864, Cape Pulmo, Lower California, 9 specimens; Cat. No. 264297, south end of Tiburon Island, Gulf of California, 2 specimens; Cat. No. 264979, San Josef Island, Gulf of California, 12 specimens; Cat. No. 264990, Agua Verde Bay, Gulf of California, 14 specimens; Cat. No. 266657, San Francisquito Bay, Gulf of California, 3 specimens; Cat. No. 267154, San Francisquito Bay, Gulf of California, 12 specimens; Cat. No. 271616, Mazatlan, Mexico, 5 specimens.

RISSOINA FORTIS C. B. Adams.

Plate 29, figs. 5, 6.

Rissoa fortis C. B. ADAMS, Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, p. 402.

Shell large, elongate-conic, milk-white. Nuclear whorls smooth, well rounded, separated by constricted sutures. Post-nuclear whorls flattened in the middle, roundly shouldered at the summit, marked by very regular, slightly sinuous, moderately protracted, well rounded axial ribs, of which 12 occur upon the first, 14 upon the second, 18 upon the third, 22 upon the fourth, 28 upon the fifth and sixth, and 30 upon the penultimate turn. These ribs extend prominently from the summit of the whorls to the umbilicus. Intercostal spaces a little wider than the ribs on the early turns, and about as wide on the later, marked by exceedingly fine and very numerous spiral threads. Sutures slightly sinuous. Periphery of the last whorl well rounded. Base short, well rounded, marked by the continuation of the axial ribs and about 13 spiral threads, which are much coarser than those on the spire. Aperture very oblique, auriculate, slightly channeled posteriorly and anteriorly, somewhat effuse at the junction of the basal and outer lip; outer and basal lip very much thickened at the edge; columella short, with a decided notch at its junction with the basal lip, reflected over and appressed to the base, where it appears as a thick callus; parietal wall covered with a thick callus, which joins the outer lip and the columella.

Thirty-one specimens of this species were collected by Professor Adams under stones, near low-water mark, at Taboga, Panama. We have figured two of these; the larger has 8 whorls and is minus the nucleus, and measures: Length, 7.5 mm.; diameter, 3 mm. The smaller has lost the first nuclear turn, and has 8 postnuclear whorls and measures: Length, 6 mm.; diameter, 2.7 mm. In addition to these two, 14 specimens of the type lot remain in the C. B. Adams' collection at Amherst. The United States National Museum has one, Cat. No. 204101, which was collected by the U. S. Bureau of Fisheries steamer *Albatross* on the beach at Taboquilla Island, Bay of Panama, and two additional specimens, Cat. No. 272937, from Panama.

RISSOINA GISNA, new species.

Plate 28, fig. 1.

Shell of medium size, bluish white, elongate-conic. Nuclear whorls 2½, well rounded, smooth, forming a pupoid apex. Postnuclear whorls short, truncated, shouldered at the summit, moderately rounded, marked by decidedly protractive, feebly curved axial ribs, of which 14 occur upon the first, 16 upon the second to fourth, 18 upon the fifth and sixth, and 20 upon the penultimate turn. These ribs extend prominently to the summit and render the sutures sinuous. Intercostal spaces about two times as wide as the ribs, crossed by exceedingly fine spiral striations. Sutures well marked. Base short, moderately rounded, without fasciole, marked by the continuations of the axial ribs which extend undiminished to the umbilical chink. The intercostal spaces and the ribs are crossed by 13 slender, equal, and equally spaced, low, spiral cords which appear as coils of a bandage, the posterior edge of which is free. The extreme anterior portion of the base is free of spiral sculpture. Aperture small, channeled anteriorly and posteriorly; outer lip thin within, reinforced immediately behind the edge by a strong varix; inner lip thin, sinuous, appressed to the base, the anterior portion is so arranged as to give the aperture the appearance of having a truncated columella. Peritreme complete.

The type and 15 specimens, Cat. No. 46158, U.S.N.M., come from Pearl Island, Panama. The type, a perfect specimen, has 8 postnuclear whorls, and measures: Length, 7 mm.; diameter, 3 mm. Cat. No. 23331, U.S.N.M., contains 3 specimens from the same place. Cat. No. 204118, U.S.N.M., contains 2 specimens from Perico Island, Bay of Panama. Cat. No. 272936, U.S.N.M., 7 specimens from Panama.

RISSOINA INCA D'Orbigny.

Plate 31, figs. 6, 8.

Rissoina inca D'ORBIGNY, Voy. Amer. Merid., 1840, p. 395, pl. 53, figs. 11-16.

Shell broadly conic, yellowish white, with a pinkish suffusion. Nuclear whorls smooth. Postnuclear whorls shouldered at the summit, which is rendered wavy by the axial ribs. Axial ribs strong, sinuous, about half as wide as the deep spaces that separate them. Of these ribs, 10 occur upon the first, 12 upon the second and third, 14 upon the fourth, and 16 or 17 upon the last whorl. These ribs extend prominently from the summit of the whorls to the umbilical area. The intercostal spaces are marked by fine spiral striations. Sutures rendered sinuous by the strongly developed ribs. Base well rounded, marked by a continuation of the axial ribs and strongly incised spiral cords, of which more than 15 are present. Aperture ear-shaped; outer lip reinforced immediately behind the edge by a thick callus; columella somewhat twisted and deflected; parietal wall covered with a thick callus, which renders the peritreme complete.

The type has 6 postnuclear whorls, and measures: Length, 8 mm.; diameter, 3 mm.

The species was collected by D'Orbigny in the neighborhood of Arica, Peru, and Cobija, Bolivia.

I have copied the figure given by Gustav Schwartz von Mohrenstern, in his monograph on the Family Rissoidae Besons. Abdr., vol. 19, Denksch. Math. Naturw. Class, Kais. Akad. Wissensch., p. 40, pl. 1, fig. 1, 1860, which gives more detail than Orbigny's original figure, which is a rather poor drawing. Mohrenstern says that Orbigny had found this species very abundant and had collected more than 1,000 specimens of it, and had been very generous in the distribution of his material.

This species is the type of the genus *Rissoina*, which was established by Orbigny in the same work in which he gives status to the present form.

RISSOINA FAVILLA, new species.

Plate 28, fig. 3.

Shell of medium size, bluish white, semitranslucent. Nuclear whorls decollated, except the last turn, which is smooth. Postnuclear whorls flattened in the middle, well rounded at the shouldered summit, marked by strong, very regular, somewhat curved protractive axial ribs, of which 14 occur upon the first and second, 18 upon the third, 20 upon the fourth, 22 upon the fifth, 26 upon the sixth and penultimate turn. These ribs extend prominently to the summit and render the sutures feebly wavy. Intercostal spaces as wide as the ribs, crossed between the sutures by very many, exceedingly fine, spiral striations. Sutures strongly marked. Base of the last whorl well rounded, marked by the continuations of the axial ribs which extend prominently to the umbilical chink and by about ten rather distantly spaced, spiral threads between which numerous, very fine, spiral striations occur. These threads extend prominently across the intercostal spaces, becoming obsolete on the ribs. Aperture rather large, very oblique, channeled anteriorly and posteriorly; outer lip thick, reinforced immediately behind the edge by a strong varix; inner lip appressed to the base, thick, sinuous, so arranged as to give the aspect of having a partially truncated columella. Peritreme complete.

The type, Cat. No. 4162*b*, U.S.N.M., comes from Cape San Lucas. It has the last nuclear whorl and 8 postnuclear turns and measures: Length, 7.1 mm.; diameter, 3 mm. Cat. No. 4062*a*, U.S.N.M., contains 2 specimens from the same locality. Cat. No. 46160, U.S.N.M., 1 specimen from Santa Maria Bay, Lower California.

RISSOINA MAZATLANICA, new species.

Plate 30, figs. 1, 3.

Shell small, elongate-conic, milk white. Nuclear whorls small, 1½, forming a depressed spire which gives the apex of the shell a truncated appearance. Post-nuclear whorls moderately rounded, appressed at the summit, marked by moderately strong, quite regularly disposed, rounded axial ribs, of which 14 occur upon the first and second, 16 upon the third, 18 upon the fourth, 24 upon the fifth, and 26 upon the penultimate turn. These ribs become somewhat enfeebled toward the summit, where they render the suture feebly sinuous. Intercostal spaces about as wide as the ribs, crossed between the sutures by numerous microscopic striations. Sutures feebly impressed. Base rather short, well rounded, marked by the continuations of the axial ribs and 13 equal, and equally spaced, slender, spiral threads which extend prominently across the intercostal spaces and become obsolete on the ribs. Aperture small, channeled anteriorly and posteriorly; outer lip very thick; reinforced immediately behind the edge by a strong varix; inner lip very thick, sinuous, appressed to the base, the anterior portion being so arranged as to give the aperture the appearance of having a truncated columella.

The 2 cotypes and 9 other specimens, Cat. No. 46153, U.S.N.M., come from the Gulf of California. The young specimen of the two cotypes shows the nuclear whorls. The adult has lost all the nuclear turns, having 7 postnuclear whorls, which measure: Length, 6 mm.; diameter, 2.2 mm. Cat. No. 46154, U.S.N.M., contains 9 specimens from the Gulf of California. Cat. No. 46165, U.S.N.M., 4 specimens from the same place. Cat. No. 23763, U.S.N.M., 3 specimens from Mazatlan. Cat. No. 46153, U.S.N.M., 3 specimens from the Gulf of California. Cat. No. 59338, U.S.N.M., 20 specimens from Acapulco, Mexico. Cat. No. 251588, U.S.N.M., 3 specimens from Puerto Angeles, Oaxaca, Mexico.

RISSOINA HELENA, new species.

Plate 28, fig. 2.

Shell elongate-conic, yellowish white. (Nuclear whorls decollated.) Postnuclear whorls moderately rounded, very weakly shouldered at the summit, marked by very strong, slightly protractive axial ribs, of which 14 occur upon the first, 16 upon the second, 18 upon the third, and 22 upon the penultimate turn. Intercostal spaces about as wide as the ribs, marked between the sutures by about 30 well incised spiral striations, which are about as far apart as the spaces that separate them, causing these to appear as slender lirations. Base moderately long, well rounded, without fasciole, marked by the continuations of the axial ribs which extend to the umbilical chink and numerous spiral lirations, which are a little stronger here than on the spire. Aperture small, slightly channeled anteriorly and posteriorly; outer lip thick, reinforced immediately behind the edge by a thick varix; inner lip thick, appressed to the base, thickening anteriorly in such a way as to give the aperture the aspect of having a truncated columella.

The type and another specimen of this species, Cat. No. 149341, U.S.N.M., come from Peru. The type has 6 postnuclear whorls and measures: Length, 7.2 mm.; diameter, 3.1 mm.

RISSOINA IO, new species.

Plate 28, fig. 4.

Shell large, elongate-conic, yellowish white. Nuclear whorls decollated. Postnuclear whorls slightly rounded, almost flattened in the middle between the sutures, weakly shouldered at the summit, marked by strong, rounded, slightly sinuous, decidedly protractive axial ribs which are about one-half as broad as the spaces that separate them. Of these ribs, 12 occur upon the first, 14 upon the second, 16 upon the third and fifth, 18 upon the sixth, 20 upon the seventh and penultimate turn. These ribs extend prominently to the summit, rendering the suture sinuous. Intercostal spaces marked between the sutures by numerous exceedingly fine, closely spaced, spiral striations. On the later turn a few of the coarser basal threads appear immediately above the suture. Base moderately long, marked by continuations of the axial ribs, which extend prominently to the umbilical chink, where they become somewhat fused, forming a basal fasciole. The spiral structure of the base consists of about 15 threads, which pass over the intercostal spaces and the axial ribs. The spaces separating these threads are almost equal to the threads in width. Aperture small, oblique, auricular, slightly channeled anteriorly and posteriorly. Outer lip thin at the edge, reinforced immediately behind the edge by a strong varix. Inner lip thick, appressed to the base, free only at the extreme anterior margin, connecting with the outer lip at the posterior margin and rendering the peritreme complete.

The type and another specimen, Cat. No. 46161, U.S.N.M., come from the Galapagos Islands. The type has 9 postnuclear whorls and measures: Length, 9 mm.; diameter, 3.5 mm. Cat. No. 56348, U.S.N.M., contains another specimen from the same locality.

RISSOINA DINA, new species.

Plate 29, fig. 4.

Shell medium size, elongate-conic, yellowish white. Nuclear whorls decollated. Postnuclear whorls moderately rounded, feebly shouldered at the summit, marked by strongly rounded, somewhat sinuous, protractive axial ribs of which 12 occur upon the first, 14 upon the second, 16 upon the third and fourth, 18 upon the fifth, 22 upon the sixth and the penultimate turn. These ribs extend prominently to the summit of the whorls, rendering the suture sinuous. Intercostal spaces about one and one-half times as wide as the ribs, marked between the sutures by exceedingly fine spiral striations. Base moderately long, marked by the continuations of the axial ribs, which extend prominently to the anterior portion of the base passing over the well-expressed fasciole. The spiral sculpture of the base consists of 16 low, broad cords which pass over the intercostal spaces and the ribs, appearing on the latter as overlapping tiles, the free edge being directed posteriorly. Aperture very oblique, small, auricular, channeled anteriorly and posteriorly; outer lip very thick within, reinforced immediately behind the edge by a strong varix; inner lip very thick, appressed and adnate to the base throughout its entire length.

The type and two other specimens, Cat. No. 56350, U.S.N.M., come from the Galapagos Islands. The type has 8 postnuclear whorls and measures: Length, 7 mm.; diameter, 3 mm.

RISSOINA EXPANSA Carpenter.

Plate 28, fig. 5.

Rissoina expansa CARPENTER, Ann. and Mag. Nat. Hist., ser. 3, vol. 15, 1865, pp. 399–400.

Shell broadly conic, bluish white, semitranslucent. Nuclear whorls decollated. Postnuclear whorls increasing rapidly in size, much broader at the sutures than at the summit, which is almost appressed; marked by low, broad, axial ribs which are less elevated and much wider at the periphery of the whorls than at the summit. Of these ribs, 16 occur upon the first, 18 upon the second and third, 22 upon the fourth, and 24 upon the penultimate turn. On the last two turns, these axial ribs become obsolete a little posterior to the periphery, leaving a narrow, smooth band in the sutures and on the posterior half of the base of the last whorl. The intercostal spaces are triangular in shape, being broader at the summit and narrowing at the suture, or periphery in the case of the last whorl. These spaces are not quite as wide as the ribs and are crossed by numerous, fine, spiral striations. Base inflated, well rounded, slightly concaved anteriorly, marked by very feeble continuations of the axial ribs which are scarcely more expressed than lines of growth and about 13 spiral cords which are situated on the anterior half of the base growing gradually weaker from the anterior portion of the base to the middle. Aperture very oblique, strongly channeled anteriorly and posteriorly; outer lip thick, claw-shaped; inner lip moderately thick, sinuous, strongly appressed to the base and so arranged as to give the aperture the aspect of having a truncated columella.

Doctor Carpenter's type, Cat. No. 15954, U.S.N.M., comes from Mazatlan, Mexico. It has lost the nucleus and probably the first 2 postnuclear turns. The 5 remaining measure: Length, 9.1 mm.; diameter, 4.7 mm. Cat. No. 59339, U.S.N.M., contains 2 specimens from Acapulco. Cat. No. 271642, U.S.N.M., 1 specimen from Guaymas, the latter a perfect specimen in every way excepting the lost nucleus. The 2 early postnuclear whorls in this have 14 and 16 axial ribs respectively. The spiral sculpture is a little more strongly expressed on the early whorls than on the succeeding turns.

RISSOINA PENINSULARIS, new species.

Plate 29, fig. 1.

Shell of medium size, elongate-conic, bluish white, semitranslucent. Early nuclear whorls decollated, one only remaining which is smooth. Postnuclear whorls increasing very regularly in size, flattened, much wider at the sutures than at the appressed summit, marked by very regular, moderately strong, protractive axial ribs of which 16 occur upon the first, 18 upon the second, 22 upon the third, 24 upon the fourth, 30 upon the fifth, and 32 upon the penultimate turn. These ribs extend prominently to the summit, which they render feebly crenulated. Intercostal spaces as wide as the ribs, crossed by numerous, well-defined, equal, and equally spaced, incised, spiral lines, 28 of which occur between the sutures on the last turn. Sutures feebly impressed. Base of last whorl rather long, moderately rounded, marked by the continuations of the axial ribs which become very much enfeebled on the anterior portion of the base. In addition to the axial ribs, the base is marked with 19 almost equal and almost equally spaced spiral threads; these, in conjunction with the axial ribs, give the base a cancellatedly sculptured appearance. Aperture large, channeled anteriorly and posteriorly; outer lip patulous, very thick, reinforced immediately behind the edge by a strong varix; inner lip moderately thick, sinuous, appressed to the base and so arranged as to lend the aperture the aspect of having a partially truncated columella.

The type and another specimen, Cat. No. 56349, U.S.N.M., come from Cape San Lucas. The type has the last nuclear whorl and 7 postnuclear turns and measures: Length, 6 mm.; diameter, 1.5 mm. Cat. No. 45156, U.S.N.M., contains another specimen from the Gulf of California.

RISSOINA ADAMSI, new species.

Plate 30, fig. 5.

Rissoa janus var. *a*. C. B. ADAMS, Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, p. 403.

Shell elongate-conic, bluish-white with a faint narrow, yellowish-white band marking the anterior boundary of the posterior third of the spaces between the sutures. Nuclear whorls decollated. Postnuclear whorls slightly rounded, appressed at the summit, marked by very regular, moderately protractive, slightly curved axial ribs, which are about as wide as the spaces that separate them. Of these ribs, 20 occur upon the second, 26 upon the third, 30 upon the fourth, 36 upon the fifth and the penultimate whorl. The shallow intercostal spaces are crossed by well-impressed spiral lines, of which about 25 occur between the sutures on the antepenultimate whorl. Sutures well impressed. Base short, prolonged, well rounded, marked by the feeble continuation of the ribs on the posterior two-thirds below the periphery, by about 13 spiral series of pits, which are broader and more deeply impressed than those of the spire, while on the extreme anterior portion of the base the spiral lines again become weakened. Aperture large, very oblique, decidedly patulous at the junction of the outer and basal lip. Posterior angle acute; outer lip very much thickened at the edge. Columella short, with a decided twist a little posterior to its junction, with the basal lip reflected over and appressed to the base; parietal wall covered with a thick callus, which connects the columella with the outer lip.

The type, which is in the Amherst collection, and comes from Panama, has lost the nucleus and the first portion of the postnuclear whorl. The 7 remaining whorls measure: Length, 6 mm.; diameter, 2.3 mm.

RISSOINA TOWNSENDI, new species.

Plate 29, fig. 3.

Shell of medium size, elongate conic, bluish white. Nuclear whorls 3½, well rounded, smooth, shining; post-nuclear whorls appressed at the summit, moderately rounded, marked by strong, well-rounded, slightly protractive, axial ribs, of which 16 occur upon the first, 18 upon the second, 24 upon the third, 26 upon the fourth, 38 upon the fifth, and 52 upon the last turn. The intercostal spaces on the first 3 whorls are a little more than twice as wide as the ribs, while on the next 2 they are about double as wide. On the last turn, however, they are only about one and one-half times as broad as the ribs. In addition to the axial sculpture, the intercostal spaces are marked by well-incised spiral lines, of which about 22 occur on the penultimate turn. Sutures slightly impressed. Base somewhat produced, marked by the continuation of the axial ribs which extend to the umbilical chink, and by 13 well-rounded, somewhat irregularly spaced, spiral cords which are not quite as wide as the spaces that separate them. Aperture auricular; outer lip slightly channeled at the posterior angle and at the junction of the outer and basal lip; outer lip reinforced by a thick callus immediately behind the edge; columella short, stout, twisted and reflected over and appressed to the base; parietal wall covered with a thick callus which renders the peritreme complete.

The type and 2 additional specimens, Cat. No. 266290, U.S.N.M., were dredged by the author at Agua Verde Bay, Lower California.

The type has 6 postnuclear whorls and measures: Length, 5.3 mm.; diameter, 2.1 mm. Two additional lots of this species, both collected by the author in the Gulf of California, are in the collection of the U.S.N.M.: Cat. No. 265934, 1 specimen dredged in shallow water at Mulege, and Cat. No. 267287, Gulf of California.

RISSOINA BARTHELOWI, new species.

Plate 29, fig. 2.

Shell very regularly elongate-conic, bluish white, nuclear whorls 3, well rounded, smooth. Postnuclear whorls decidedly appressed at the summit, slightly rounded, the first two with a strong spiral cord which becomes decidedly weakened on the third whorl and disappears on the fourth. Axial sculpture consisting of closely placed somewhat sinuous, rounded ribs which are much wider than the spaces which separate them, on the later whorls. On the first three turns the intercostal spaces are about twice as wide as the ribs. Of these ribs 16 occur upon the first and second, 18 upon the third, 24 upon the fourth, 30 upon the fifth, and 38 upon the sixth and penultimate whorl. The intercostal spaces are crossed by spiral lirations, of which three occur between the summit and the shoulder on the first three turns and three between the shoulder and the base of the same turns. These spiral threads become less strong on the succeeding turns, and more closely spaced. On the last whorl 15 are present between the summit and the periphery. The spiral threads are not quite as wide as the spaces that separate them. Sutures moderately impressed. Periphery of the last whorl slightly angulated. Base rather short and well rounded, marked by the continuations of the axial ribs, and 20 spiral cords which become successively stronger from the periphery to the umbilical area. Aperture very oblique, decidedly channeled at the posterior angle and at the junction of the columella and the basal lip; outer lip decidedly twisted, reinforced immediately behind the edge with a thick callus, posterior portion drawn forward into a claw-shaped element; columella short, twisted, reflected over and appressed to the base; parietal wall covered with a thick callus, which renders the peritreme complete.

The type and 106 specimens of this species, Cat. No. 267666, were dredged by the author at the head of Concepcion Bay, Lower California, in 2 to 4 fathoms of water. The type has 8 postnuclear whorls and measures: Length, 7 mm.; diameter, 3 mm.

RISSOINA KELSEYI Dall and Bartsch.

Plate 30, fig. 4.

Rissoa kelseyi Dall and Bartsch, The Nautilus, vol. 16, 1902, p. 94=*Alaba oldroydi* Dall, The Nautilus, vol. 19, 1905. p. 15,

Shell cylindric-conic, varying in color from yellow to light red, unicolor or longitudinally streaked. Nuclear whorls 2, well rounded, smooth. Postnuclear whorls slightly shouldered at the summit, marked by obsolete, broad, rounded, low, axial ribs, of which 12 occur upon the first and second, and 14 upon the third and fourth, while on the penultimate whorl they are altogether wanting. In addition to the axial ribs, the whorls are marked by strongly incised, spiral lines, which are a little closer spaced at the summit of the whorls than at the suture. Of these, 15 occur upon the third, and 22 upon the penultimate turn between the sutures. Suture moderately constricted. Periphery of the last whorl well rounded. Base moderately long, well rounded, marked like the spire by about 10 subequal and irregularly spaced, incised, spiral lines. Aperture irregularly oval, oblique; posterior angle obtuse; outer lip thick;

columella short, strongly curved and decidedly reflected over and appressed to the base; parietal wall covered with a thick callus, which joins the posterior angle of the aperture to the reflected edge of the columella, rendering the peritreme complete.

The type and 2 specimens, Cat. No. 168605, U.S.N.M., come from San Diego, California. The type has 6 postnuclear whorls and measures: Length, 6.3 mm.; diameter, 2.5 mm.

The following specimens have been examined:

Cat. No. 168605, U.S.N.M., 3 specimens from San Diego, California, one = figured type. Cat. No. 158771, U.S.N.M., 2 specimens from San Pedro, California, dredged in 10 fathoms (type of *A. oldroydi* Dall.). Cat. No. 128355, U.S.N.M., 8 specimens from San Pedro, California (beach drift and also living). Cat. No. 151732, U.S.N.M., 4 specimens from San Pedro, California. Cat. No. 213368, U.S.N.M., U.S.B.F. station 2932, 20 specimens off Coronados, California, in 20 fathoms, on gray sand and broken shell bottom. Cat. No. 271643, U.S.N.M., U.S.B.F. station 4347, off Point Loma Light, California, in 55–58 fathoms, on fine gray sand, broken shell, sponge, and mud bottom. (One specimen.)

RISSOINA LAPAZANA, new species.

Plate 30, fig. 6.

Shell of medium size, milk white, excepting a single narrow peripheral band of golden brown. Nuclear whorls large, a little more than two, well rounded, forming a mammilated apex. Postnuclear whorls well rounded, appressed at the summit, overhanging, and marked by about 14 feebly developed, distantly spaced axial ribs which are obsolete on the first and last turns. These ribs are about one-third as wide as the spaces that separate them. In addition to the axial ribs the whorls are crossed by subequal and subequally spaced, sinuous, spiral threads of which 7 occur on the first, 8 on the second, 11 on the third and fourth, and about 16 on the last turn. Of these the primary threads have been split usually on their middle by the intercalation of incised lines. The lines separating these cords are narrower than the cords. Sutures well impressed. Periphery of the last whorl well rounded. Base short, well rounded, marked by about 10 low, broad, spiral cords. Aperture large; outer lip very effuse, thin, showing the external sculpture within; inner lip strongly curved, thin, reflected over and appressed to the

The type, Cat. No. 211410, U.S.N.M., was dredged by the U.S. Bureau of Fisheries steamer *Albatross* at station 2823 in 26½ fathoms on broken shell bottom off La Paz, Gulf of California. It is a perfect specimen having almost 6 postnuclear whorls and measures: Length, 6 mm.; diameter, 2 mm.

RISSOINA CONTABULATA Mörch.

Rissoina contabulata Mörch, Mal. Blatt., vol. 7, 1861, p. 68.

Shell cylindric, scalate, with straight, distantly spaced, axial ribs. Of these ribs, which are squarish, about 14 occur upon the last turn. They are sharply cusped at the summit and joined together at the periphery by a strong spiral cord. Suture channeled. The axial ribs on the last whorl are joined on the middle by a squarish spiral cord. Columella encircled by a spiral cord. Aperture triangular lunate. Length, 3 mm.; diameter, 1 mm. A single specimen from Sonsonate.

To the above Mörch adds:

> *Rissoa scalaris* Frem. Mon., fig. 32, has a great resemblance to this species, and has likewise a decollated apex. *Rissoa notabilis* Adams, Pan. Shells, p. 181, is not unlike it. The axial ribs and the two basal keels are angular with very deep interspaces.

Carpenter, [1] makes the following statement regarding the *Rissoa notabilis:*

> After drawing this unique shell carefully under the microscope, and making copious notes on the diagnosis from the specimen, an untoward cough lodged it among the meshes of the curator's carpet, whence I endeavored in vain to extricate it. This unfortunate accident, however, is the less to be regretted, as I can state with perfect confidence that it was exactly identical with another shell in the collection, p. 255, q. v.; and with M. 498, *Parthenia quinquecincta.* The "concave summits" of the ribs imply that the ribs are sharp, with concave interstices; and the "upper keel" is simply due to the angulation of the whorls. Though the lip was broken, the columellar plait as well as the sinistral apex, escaped the professor's notice.

RISSOINA HISTIA, new species.

Plate 33, fig. 9.

Shell minute, highly polished, milk white. Nuclear whorls a little more than one, smooth, well rounded. Postnuclear whorls moderately rounded, appressed at the summit, polished, marked by exceedingly fine, microscopic, incremental lines only. Sutures moderately impressed. Periphery of the last whorl well rounded, marked by a single incised line. Base moderately long, well rounded, provided with a strong fasciole anteriorly, polished, marked by a single incised line which is a little anterior to the peripheral one which it equals in length. Aperture very irregular in outline, oblique, channeled anteriorly and posteriorly; outer lip claw-shaped, twisted and sinuous, having a little projection in the middle of the basal line reinforced immediately behind by a strong varix; inner lip thin, appressed to the base with which it becomes completely fused, the continuations of the curved basal fasciole being responsible for the projection on the basal lip.

The type, Cat. No. 151927, U.S.N.M., and another specimen were dredged by the U. S. Bureau of Fisheries steamer *Albatross* at stations

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[1] Proc. Zool. Soc. London, 1863, p. 189.

2826 to 2828 in 9½ to 10 fathoms, off La Paz, Gulf of California. The type has 9 postnuclear whorls and measures: Length, 2.8 mm.; diameter, 1.1 mm.

RISSOINA ZELTNERI DeFolin.

Plate 31, fig. 3.

Rissoina zeltneri DeFolin, Les Meleagrinicoles, p. 47, 1867, pl. 5, fig. 1.

Shell elongate-conic, white, shining. Nuclear whorls smooth, well rounded, forming a helicoid spire. Postnuclear whorls marked by feebly developed, decidedly protractive, closely spaced, rounded axial ribs, of which DeFolin figures about 26 on the sixth, 28 on the seventh, 30 on the eighth, and 42 on the penultimate turn. Intercostal spaces very feebly impressed, smooth. Suture well marked. Base moderately long, slightly concaved anteriorly, crossed by the continuations of the axial ribs which extend to the umbilical chink and about 14 equal and equally spaced, spiral lirations which pass over the intercostal spaces and ribs. Aperture rather large, channeled anteriorly and posteriorly; outer lip effuse, reinforced immediately behind the edge by a strong varix; inner lip sinuous, thick and appressed to the base.

DeFolin's figure shows a shell of 10 whorls which measures: Length, 4.5 mm.; diameter, 1.8 mm. It comes either from Panama or Negritos Island (probably Negros, Philippine Islands). I have not seen this specimen.

RISSOINA LAURAE De Folin.

Plate 31, fig. 7.

Rissoina laurae De Folin, Fonds de la Mer, vol. 1, 1870, p. 263, vol. 24, fig. 3.

Shell small, ovate-conic, crystalline, shining. Apex subacute. Whorls 8, sutures moderately well impressed, the last whorl equaling the rest of the shell in length. Base well rounded, smooth, excepting a series of weakly developed spiral threads. Aperture semilunar, oblique; outer lip thickened, spirally lirated within.

De Folin's type comes from Panama and measures: Length, 2 mm.; diameter, 1 mm.

I have not seen this species and quote De Folin's description and copy his figure.

RISSOINA BURRAGEI, new species.

Plate 32, fig. 3.

Shell small, broadly conic, bluish white; nuclear whorls 2½, well rounded, smooth; postnuclear whorls somewhat inflated, shouldered near the summit, marked by very strong, curved, protractive, sublamellar axial ribs, of which 12 occur upon the first, 14 upon the second and third, 16 upon the fourth, and 18 upon the penultimate turn. These ribs become slightly attenuated near the summit, frequently fusing there, with the ribs of the preceding turn. Intercostal spaces about three times as wide as the ribs; marked by lines of growth only. Sutures well impressed. Periphery of the last whorl well rounded. Base somewhat produced, marked by the continuations of the axial ribs, which fuse at the columella and there form a somewhat tumid area. Aperture oval; slightly channeled at the posterior angle and at the junction of the columella and the outer lip; outer lip reinforced by a thick callus immediately behind the edge; columella short, very thick, and somewhat reflected and appressed to the base; parietal wall covered with a thick callus which renders the peritreme complete.

The type and 12 specimens, Cat. No. 266595, were dredged by the author in shallow water in San Francisquito Bay, Gulf of California. The type has 6 postnuclear whorls and measures: Length, 3.7 mm.; diameter, 1.6 mm.

In addition to these, the following specimens, all dredged by the author in the Gulf of California, are in the collection of the U.S.N.M.:

Cat. No. 267155, 1 specimen from the same locality; Cat. No. 264653, 1 specimen from the head of Concepcion Bay; Cat. No. 267623, 5 specimens from head of Concepcion Bay; Cat. No. 267662, an additional specimen from same locality; Cat. No. 265940, 16 specimens from Mulege; Cat. No. 266287, 2 specimens from Agua Verde Bay.

RISSOINA NEREINA, new species.

Plate 32, fig. 1.

Shell small, elongate-conic, milk white. Nuclear whorls 3, decidedly rounded, scarcely increasing in diameter, forming a pupoid apex. Postnuclear whorls well rounded, increasing regularly in size, feebly shouldered at the summit, marked by strong, retractive axial ribs which are about one-half as wide as the spaces that separate them. Of these ribs, 14 occur upon the first and second, 16 upon the third, 18 upon the fourth, and 22 upon the penultimate turn. Intercostal spaces well impressed, smooth. Suture strongly impressed, slightly sinuous. Base of the last whorl somewhat prolonged, moderately rounded, marked only by the continuations of the axial ribs which extend prominently to the umbilical area. Aperture large, feebly channeled anteriorly and posteriorly; outer lip thickened at the edge, thin deep within, where the external sculpture may be seen by transmitted light; a strong varix reinforces the outer lip immediately behind its edge. Inner lip thick, slightly sinuous, appressed to the base, rendering the peritreme complete.

The type and eight additional specimens were obtained in shell washings at Point Abreojos, Lower California. The type has 5½ postnuclear whorls and measures: Length, 4.3 mm.; diameter, 2 mm.

Cat. No. 105574, U.S.N.M., contains 9 specimens from the same locality. Cat. No. 105560, U.S.N.M., 2 specimens from San Ignacio Lagoon. Cat. No. 105545, U.S.N.M., 2 specimens from Scammons Lagoon.

RISSOINA EFFUSA Mörch.

Plate 32, fig. 7.

Rissoina effusa Mörch, Mal. Blätt., vol. 7, 1860, p. 67.

Shell small, elongate-conic, yellowish white, translucent. Of the nuclear whorls the last volution only remains, the first half of which is well rounded and smooth, while the second half bears a small, acute spiral keel on its middle. Postnuclear whorls strongly, slopingly, shouldered at the summit, marked by very flexuous, strong, acute axial ribs, of which 10 occur upon the first, 12 upon the second, 14 upon the third, and 16 upon the remaining whorls. These ribs extend prominently over the shoulder at the summit where they take a protractive curve which emphasizes decidedly the sinuosity of the ribs. The intercostal spaces are strongly impressed and about three times as wide as the ribs. Sutures moderately constricted. The periphery of the last whorl well rounded, base somewhat prolonged, well rounded, marked by the continuation of the axial ribs which extend prominently to the callus at the end. Aperture moderately large, irregularly ovate, feebly channeled anteriorly and posteriorly; outer lip moderately thick at the edge, reinforced immediately behind the edge by a strong varix; inner lip twisted and strongly curved, strongly reflected over and appressed to the base in the form of a callus; parietal wall covered by a thick callus which renders the peritreme complete. The entire peritreme is heavier in this shell than in any other we have seen from the west coast.

Our description and figure have been based upon the type which was kindly loaned to us by Mr. Ad. Jensen of the Zoological Museum, of Copenhagen. The type has 6 postnuclear whorls and measures: length, 4.8 mm.; diameter, 1.9 mm. Locality, Central America, without specific designation.

RISSOINA PLEISTOCENA, new species.

Plate 32, fig. 2.

Shell small, elongate-ovate, yellowish white. Nuclear whorls decollated. Postnuclear whorls well rounded, appressed at the summit, marked by very strong, distantly spaced, lamelliform, protractive, axial ribs which form continuous series from the apex of the shell to the base. Of these ribs 12 occur upon the first to third whorls and 14 upon the remaining turns. Intercostal spaces a little more than three times as wide as the ribs, smooth. Suture moderately impressed, rendered wavy by the strong axial ribs. Base well rounded, short, marked by the continuations of the axial ribs which extend to the umbilical area. Aperture rather large, slightly channeled anteriorly and posteriorly; outer lip very thick, reinforced immediately behind the edge by a strong varix; inner lip very thick, somewhat sinuous, appressed to the base. Peristome complete.

The type and another specimen, Cat. No. 7975, U.S.N.M., come from the Lower Pleistocene of San Diego. The type has 6 whorls and measures: Length, 4.8 mm.; diameter, 1.8 mm.

RISSOINA CALIFORNICA, new species.

Plate 33, fig. 1.

Shell very minute, elongate-conic, semi-translucent, yellowish white. Nuclear whorls 27, well rounded, smooth. Postnuclear turns well rounded, marked by strong, decidedly protractive, slightly sinuous axial ribs which are about half as wide as the spaces that separate them. Of these ribs 14 occur upon the first, and 16 upon the remaining turns. These ribs extend strongly from the summit to the sutures on each turn and are not at all constricted below the summit. The intercostal spaces are deep, well rounded, and smooth. Suture strongly impressed. Periphery of the last whorl well rounded, marked by the continuation of the axial ribs which extend over the somewhat prolonged base to the umbilical chink where they become slightly fused on the tumid area surrounding the umbilical region. Aperture oval; slightly channeled at the posterior angle and at the junction of the outer lip and the columella; outer lip reinforced immediately behind the edge by a thick callus; columella strongly reflected over and appressed to the base; parietal wall covered with a thick callus which renders the peritreme complete.

The type, Cat. No. 271644, U.S.N.M., was dredged in 3 fathoms off South Coronado Island by Doctor Baker. It has 5 postnuclear whorls and measures: Length, 2.8 mm.; diameter, 1.2 mm. Cat. No. 271645, U.S.N.M., contains the tip of a young specimen from Catalina Island, California.

RISSOINA CLANDESTINA C. B. Adams.

Plate 32, fig. 5.

Rissoa clandestina C. B. ADAMS, Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, p. 401.

Shell very small, elongate-ovate, yellowish-white. Nuclear whorls 3½, smooth, well rounded, separated by a well impressed suture. Post-nuclear whorls moderately rounded, appressed at the summit, marked by protractive, somewhat sinuous, rather strong axial ribs, of which 14 occur upon the first, 16 upon the second and third, and 20 upon the penultimate turn. The spaces between the axial ribs are about three times as wide as the ribs and are smooth. Suture rendered sinuous by the summit of the strong axial ribs. Periphery well rounded. Base moderately long, well rounded. Aperture decidedly oblique, oval; posterior angle acute, slightly channeled; outer lip very thick, reinforced by a callus on the outside; columella short, curved, very thick, reflected over and appressed to the base as a very thick callus; parietal wall covered with a thick callus which connect the outer lip and the insertion of the columella.

Three specimens of this species are in the collection of Amherst College. They were collected by Professor Adams at Panama and served for his description. The one described and figured above has 5 postnuclear whorls in addition to the nucleus, and measures: Length, 3 mm.; diameter, 1.2 mm.

RISSOINA MEXICANA, new species.

Plate 33, fig. 6.

Shell small, narrowly elongate-conic, bluish white, semi-translucent. Nuclear whorls 2, well rounded, smooth, forming a truncated pupoid apex. Postnuclear whorls appressed at the summit, moderately well rounded, marked by well developed, retractive, axial ribs which are about one-half as wide as the spaces that separate them and form continuous series from the apex to the base. Of these ribs 12 occur upon the first, 14 upon the second, 16 upon the third and the penultimate turn. Intercostal spaces smooth. Suture slightly wavy, feebly impressed. Base of the last whorl slightly produced, marked by the continuations of the axial ribs which extend prominently to the umbilical area. Aperture moderately large, weakly channeled anteriorly and posteriorly; outer lip thin within where the external sculpture is seen by transmitted light, thick at the edge and reinforced immediately behind the edge by a strong varix; inner lip thickened, appressed to the base, rendering the peritreme complete.

The type, Cat. No. 271646, U.S.N.M., was collected by the author along the rocky shores at Mazatlan. It has 4½ postnuclear whorls and measures: Length, 2.7 mm.; diameter, 1.2 mm. Cat. No. 15422, U.S.N.M., contains 1 specimen from Guacomayo, Mexico, and Cat. No. 46167, U.S.N.M., 1 specimen from the Gulf of California.

RISSOINA BAKERI Bartsch.

Plate 33, fig. 4.

Rissoina bakeri Bartsch, Nautilus, vol. 16, 1902, p. 9.

Shell small, sub-diaphanous, milk white. Nuclear whorls 2, quite large, with beveled shoulder, smooth. Postnuclear whorls well rounded, somewhat angulated at the anterior termination of the posterior fourth between the sutures, ornamented by 12 to 14 well developed, narrow, sinuous, protractive, axial ribs. Intercostal spaces about four times as wide as the ribs, marked by slender, very strong, axial threads. Sutures well impressed. Periphery of the last whorl well rounded. Base rendered concaved in the middle by a slender fasciole at its anterior termination, marked by the feeble continuations of the axial ribs and threads. Aperture large, very oblique, sub-oval, slightly notched at the posterior angle; outer lip reinforced by a thick varix immediately behind the edge; inner lip slender, strongly curved, appressed to the base, parietal wall covered with a thick callus.

The type, Cat. No. 130562, U.S.N.M., comes from San Pedro, California. It has 5 postnuclear whorls and measures: Length, 2.7 mm.; diameter, 1 mm. Cat. No. 271647, U.S.N.M., 1 specimen from Pacific Beach. Cat. No. 225186, U.S.N.M., 2 specimens dredged in 3 fathoms off Coronado Island. I have also seen it, from 12 fathoms, off Monterey, California. Cat. No. 271648, U.S.N.M., 1 specimen from Whites Point, California. Two from the same locality are in Mrs. Oldroyd's collection. One in Dr. Fred Baker's collection came from 3 to 7 fathoms, off Coronados Island, California.

RISSOINA WOODWARDII Carpenter.

Plate 31, figs. 2, 5.

Rissoina woodwardii CARPENTER, Cat. Mazatlan Shells, 1856, p. 357.

Shell small, elongate-ovate, semitranslucent. Nuclear whorls a little more than 3, smooth, forming a well elevated helicoid apex. Postnuclear whorls well rounded, marked by slender, lamelliform, protractive, axial ribs of which 12 occur upon the first and second and 14 upon the remaining whorls. These ribs are about one-fourth as wide as the spaces that separate them. The intercostal spaces are marked by lines of growth which appear as fine lirations on the early whorls, becoming obsolete on the later. Sutures strongly impressed. Aperture decidedly oblique; posterior angle acute, outer lip thickened at the edge; inner lip very thick, reflected over and appressed to the base, joining this with the outer lip to form a continuous peristome.

Seventy specimens of this species were collected on *Chama* and *Spondylus;* 11 of these are on Tablet 1706 in the Liverpool collection at the British Museum and 2 additional ones are on Tablet 1707 at the same place. Doctor Carpenter mentions in his Catalogue of Mazatlan Shells that an unusually large specimen measures: Length, 3 mm.; diameter, 0.8 mm.

I have not seen this species and figure an unpublished camera lucida drawing by Doctor Carpenter of it.

RISSOINA NEWCOMBEI Dall.

Plate 33, fig. 7.

Rissoina newcombei DALL, Bull. Nat. Soc. British Columbia, No. 2, 1897, art. 1, p. 14, pl. 1, fig. 2.

Shell small, elongate-conic, yellowish white. Nuclear whorls 2, well rounded, smooth. Postnuclear whorls well rounded, appressed at the summit, marked on the first whorl by about 30 slender, protractive, axial threads which are almost as wide as the spaces that separate them. On the second whorl about 42 of the same strength occur; here also the first indication of the more prominent ribs which are characteristic of the subsequent whorls, occurs. On the third whorl there are 14 slender, narrow, somewhat sinuous, protractive axial ribs which are about one-fourth as wide as the spaces that separate them. In the intercostal spaces of these whorls there are usually three of the finer riblets described for the whorls above. On the last whorl, the prominent riblets again become enfeebled and the surface is marked by about 36 of the finer threads. Sutures moderately impressed. Periphery of the last whorl well rounded. Base slightly concaved in the middle, marked by the continuations of the axial riblets. Aperture rather large, very oblique, slightly channeled posteriorly; outer lip claw-shaped, effuse, reinforced immediately behind the edge by a moderately thick varix; inner lip strongly curved, reflected over and appressed to the base; parietal wall covered with a moderately thick callus which renders the peritreme complete.

The type, Cat. No. 107421, U.S.N.M., was dredged in 20 fathoms in Cumsheava Inlet, Vancouver Island. It has almost 5 postnuclear whorls and measures: Length, 3 mm.; diameter, 1.1 mm.

RISSOINA CLEO, new species.

Plate 33, fig. 3.

Shell small, elongate-conic, milk white. Nuclear whorls 2, well rounded, slightly shouldered near the summit. Postnuclear whorls well rounded, very feebly shouldered at the summit, marked by slender, very distantly spaced, somewhat sinuous, decidedly protractive axial ribs, of which 16 occur upon the first, 18 upon the second and third, and 20 upon the penultimate whorl. Intercostal spaces about four times as wide as the ribs, marked by numerous, fine, irregular wavy markings which give a watered silk effect. Suture moderately constricted. Periphery well rounded. Base of last whorl moderately long, concaved in the middle, having a slender fasciole at its anterior termination, marked by the feeble continuations of the axial ribs and the same wavy sculpture observed in the intercostal spaces of the spire. Aperture large, decidedly effuse, feebly channeled posteriorly; outer lip very thick and effuse, reinforced immediately behind the edge by a thick varix; inner lip slender, curved and appressed at the base; parietal wall covered with a thick callus which renders the peritreme complete.

The type, Cat. No. 226456, U.S.N.M., was dredged in 3 fathoms off South Coronado Island. It has almost 5 postnuclear whorls and measures: Length, 2.8 mm.; diameter, 1.2 mm.

RISSOINA CERROSENSIS, new species.

Plate 33, fig. 5.

Shell elongate-ovate, diaphanous. Nuclear whorls 2, well rounded, smooth. Postnuclear whorls well rounded, appressed at the summit, smooth, excepting feeble lines of growth and an occasional stronger thread. Suture moderately constricted. Periphery of the last whorl well rounded. Base moderately well rounded, without fasciole, marked like the spire. Aperture rather large, decidedly oblique, effuse at the junction of the outer and basal lips, feebly channeled anteriorly; outer lip thin; inner lip strongly curved, reflected over and adnate to the base; parietal wall covered with a moderately thick callus.

The type, Cat. No. 129318, U.S.N.M., was dredged by the U. S. Bureau of Fisheries steamer *Albatross* at station 2983 in 58 fathoms on sand bottom, bottom temperature 55°, off Cerros Island, Lower California. It has 5 postnuclear whorls and measures: Length, 2.4 mm.; diameter, 1.2 mm.

RISSOINA DALLI, new species.

Plate 33, fig. 2.

Shell small, elongate-conic, subdiaphanous. Nuclear whorls almost 2, inflated, well rounded, smooth. Postnuclear whorls moderately rounded, appressed at the summit, the appressed portion being somewhat excurved, lending the whorls the aspect of having a double suture. Whorls marked by numerous, very fine, closely spaced, almost vertical, axial threads which are about as wide as the spaces that separate them. Suture feebly impressed. Periphery of the last whorl well rounded. Base moderately long, well rounded, marked like the spire. Aperture moderaly large, ovate; outer lip somewhat effuse, thick at the edge, thin within where the external sculpture is seen through the substance of the shell; inner lip moderately thick, strongly curved, reflected over and adnate to the base. Parietal wall covered with a thick callus which renders the peritreme complete.

Cat. No. 107281, U.S.N.M., contains the type and 18 specimens from San Pedro, Cal. The type has almost 6 postnuclear whorls and measures: Length, 2.8 mm.; diameter, 1 mm. Sixty-one specimens were examined from the same locality, in Mrs. Oldroyd's collection. Cat. No. 129334, U.S.N.M., contains 8 specimens from San Pedro. Cat. No. 225187, U.S.N.M., 3 specimens, dredged in 3 fathoms off South Coronado Island.

RISSOINA CORONADENSIS, new species.

Plate 33, fig. 8.

Shell small, elongate-conic, milk white. Nuclear whorls a little more than 2, well rounded, smooth. Postnuclear whorls moderately rounded, appressed at the summit, the appressed portion slightly excurved, marked by slender, slightly protractive, somewhat sinuous, axial threads of which 40 occur upon the first, 42 upon the second, 48 upon the third, 56 upon the fourth, and 52 upon the penultimate turn. These threads are separated by intercostal spaces about as wide as the threads. Suture well impressed. Periphery of the last whorl well rounded. Base rather short, slightly concaved, marked by the continuations of the axial threads which extend undiminished to the umbilical area. Aperture oval, posterior angle acute; outer lip thin at the edge, thickened immediately behind the edge by a varix, thin deep within where the external sculpture shines through the substance of the shell; inner lip short, strongly curved, reflected over and adnate to the base; parietal wall covered with a thick callus which renders the peritreme complete.

The type, Cat. No. 271649, U.S.N.M., was dredged by the U. S. Bureau of Fisheries steamer *Albatross* at station 2932 in 20 fathoms, on gray sand and broken shell bottom, bottom temperature 58°, off Los Coronados Islands. The type has 6 postnuclear whorls and measures: Length, 3.5 mm.; diameter, 1.3 mm. Cat. No. 271650, U.S.N.M., 1 specimen, dredged by the *Albatross* at station 4309 in 67 to 78 fathoms on sand, shell and rocky bottom, off Point Loma, California. Cat. No. 162663, U.S.N.M., 1 specimen from San Martin Island, Lower California.

RISSOINA JANUS C. B. Adams.

Plate 32, fig. 8.

Rissoa janus C. B. ADAMS, Ann. Lyc. Nat. Hist. N. Y., vol. 5, 1852, p. 403.

The type of *R. janus* in the Amherst collection, collected by C. B. Adams, at Panama, is a very badly worn medium sized Rissoina, in which the ribs have been worn down to such an extent that one can scarcely count them. There are probably 20 on each of the last 2 whorls. It is absolutely impossible to decide whether spiral sculpture may have been present or absent. The only thing that will help in the identification of the present form with good material is the outline. The part of the original description referring to this character evidently belongs to var. *a*, which is now named *R. adamsi*.

The specimen has lost the nucleus; the 6 whorls remaining measure: Length, 4.5 mm.; diameter, 2mm.

I have seen nothing in the collection examined that we could refer to this species.

RISSOINA (Folinia) SIGNAE, new name.

Plate 31, figs. 1, 4.

=*Rissoa insignis* DE FOLIN, Meleagrinicoles, 1867, pp. 48–49, pl. 5, figs. 2 and 3, not *Rissoa insignis* Adams and Reeve, 1850.

Shell elongate-ovate, white. Nuclear whorls 2, well rounded, smooth; post-nuclear whorls exceedingly, strongly, tabulatedly shouldered at the summit, the axial ribs terminating at the angle of the shoulders in strong cusps. Axial ribs 12 upon all the turns, strong, sublamellar. Intercostal spaces about three times as wide as the ribs, crossed by very regular, fine, spiral striations. Sutures rendered deeply channeled by the summit of the whorls and wavy by the strong axial ribs. Periphery well rounded, base somewhat produced, marked by the continuations of the axial ribs, which become evanescent on the middle and fine spiral striations; anteriorly at the insertion of the columella a strong fasciole is present. Aperture oval, consisting of almost two openings—one the main portion, the other smaller portion connected with this by a narrow slit. It is really formed by a triangular projection of the strongly callused outer lip and another, equally strong, projecting inward from the strong parietal callus to meet this; columella strongly curved.

The type, which is said to come from Negrito Island (loc. ?) or Margarita Island, Bay of Panama, measures: Length, 2.2 mm.; diameter, 1.2 mm.

EXPLANATION OF PLATES.

The measurement cited after each species is the actual length of the specimen.

PLATE 28.

FIG. 1. *R. gisna*, new species, type, 7 mm., p. 41.
2. *R. helena*, new species, type, 7.2 mm., p. 44.
3. *R. favilla*, new species, type, 7.1 mm., p. 43.
4. *R. io*, new species, type, 9 mm., p. 44.
5. *R. expansa* Carpenter, type, 9.1 mm., p. 46.
6. *R. stricta* Menke, 8.7 mm., p. 39.

PLATE 29.

FIG. 1. *R. peninsularis*, new species, type, 6 mm., p. 46.
2. *R. barthelowi*, new species, type, 7 mm., p. 48.
3. *R. townsendi*, new species, type, 5.3 mm., p. 48.
4. *R. dina*, new species. The fine sculpture on the spire has been omitted. Type, 7 mm., p. 45.
5. *R. fortis* C. B. Adams. The fine sculpture on the spire has been omitted. Cotype, 7.5 mm., p. 40.
6. *R. fortis* C. B. Adams. The fine sculpture on the spire has been omitted. Cotype, 6 mm., p. 40.

PLATE 30.

FIG. 1. *R. mazatlanica*, new species, cotype, 6 mm., p. 43.
2. *R. excolpa*, new species, type, 4.1 mm., p. 39.
3. *R. mazatlanica*, new species, cotype, p. 43.
4. *R. kelseyi* Dall and Bartsch type, 6.3 mm., p. 49.
5. *R. adamsi*, new species, type, 6 mm., p. 47.
6. *R. lapazana*, new species, type, 6 mm., p. 50.

PLATE 31.

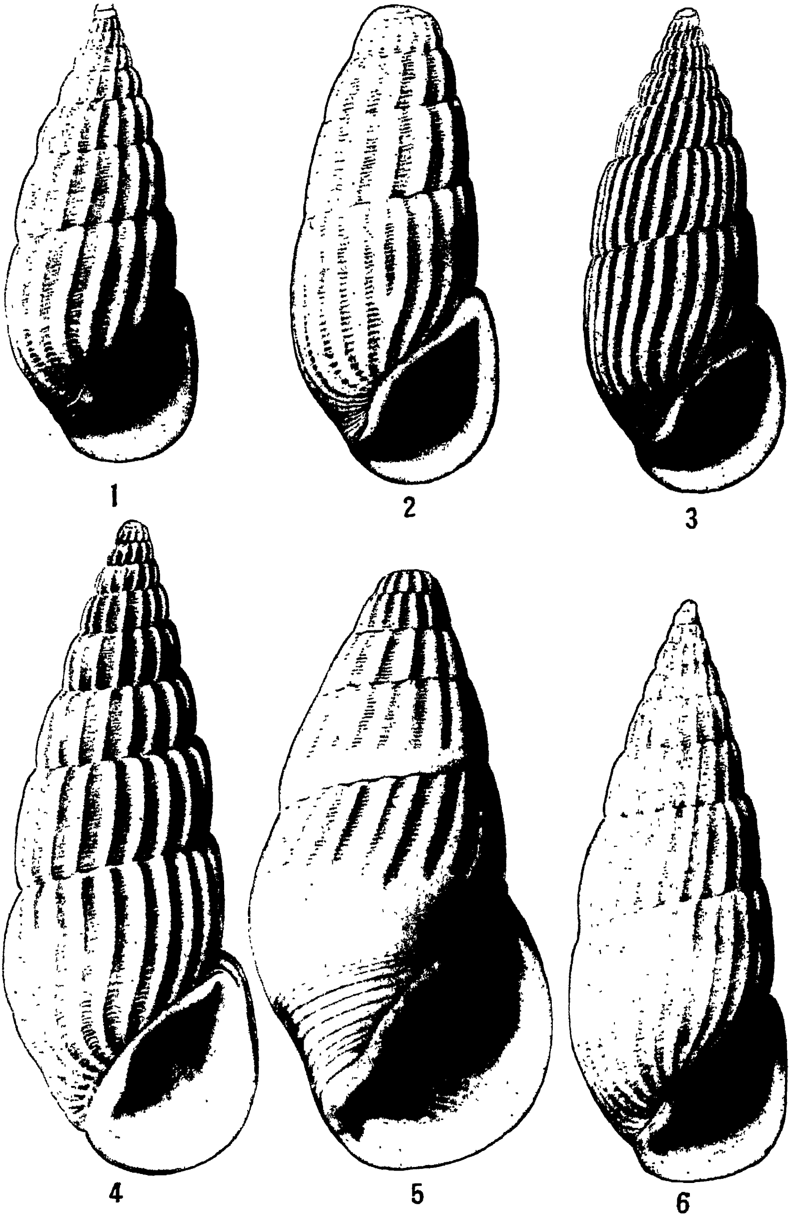
FIG. 1. *R. signae*, new name, type, 2.2 mm., p. 61.
2. *R. woodwardii* Carpenter, back view, cotype, 3 mm., p. 57.
3. *R. zeltneri* De Folin, type, 4.5 mm., p. 52.
4. *R. signae*, new name, back of basal portion of last whorl, p. 61.
5. *R. woodwardii* Carpenter, cotype, 3 mm., p. 57.
6. *R. inca* D'Orbrigny, 8 mm., p. 42.
7. *R. laurae* De Folin, type, 2 mm., p. 52.
8. *R. inca* D'Orbigny, 8 mm., p. 42.

PLATE 32.

FIG. 1. *R. nereina*, new species, type, 4.3 mm., p. 53.
2. *R. pleistocena*, new species, type, 4.8 mm., p. 54.
3. *R. burragei*, new species, type, 3.7 mm., p. 52.
4. *R. firmata* C. B. Adams, type, 4.7 mm.=type of *R. scalariformis*, p. 38.
5. *R. clandestina* C. B. Adams, type, 3 mm., p. 55.
6. *R. firmata* C. B. Adams, type, 4.7 mm., p. 38.
7. *R. effusa* Mörch, type, 4.8 mm., p. 54.
8. *R. janus* C. B. Adams, type, 4.5 mm., p. 60.

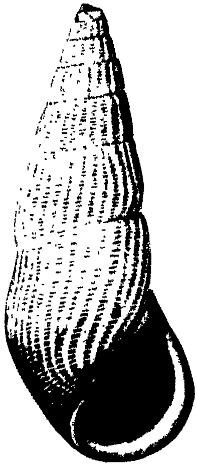
PLATE 33.

FIG. 1. *R. californica*, new species, type, 2.8 mm., p. 55.
2. *R. dalli*, new species, type, 2.8 mm., p. 59.
3. *R. cleo*, new species, type, 2.8 mm., p. 58.
4. *R. bakeri* Bartsch, type, 2.7 mm., p. 56.
5. *R. cerrocensis*, new species, type, 2.4 mm., p. 59.
6. *R. mexicana*, new species, type, 2.7 mm., p. 56.
7. *R. newcombei* Dall, type, 3 mm., p. 58.
8. *R. coronadoensis*, new species, type, 3.5 mm., p. 60.
9. *R. histia*, new species, type, 2.8 mm., p. 51.



RECENT AND FOSSIL WEST AMERICAN RISSOINAS.

FOR EXPLANATION OF PLATE SEE PAGE 61.



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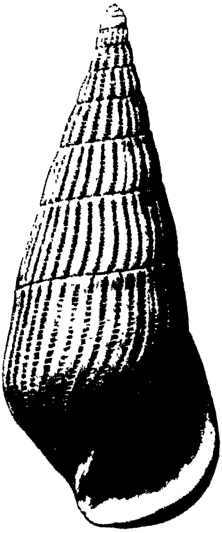

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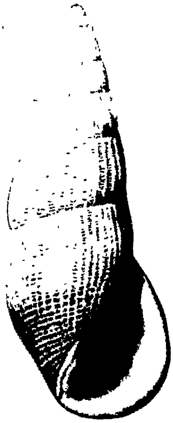

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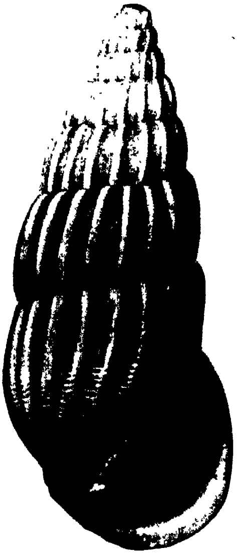

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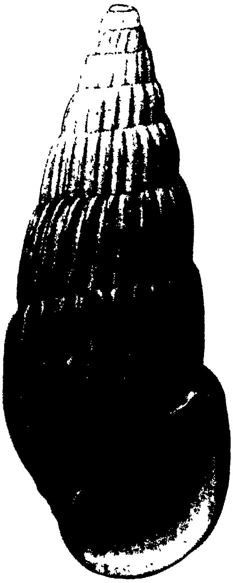

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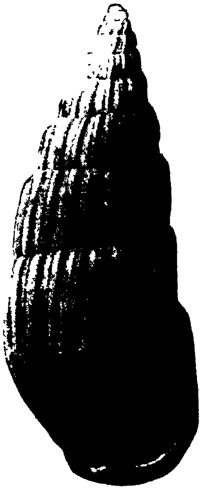

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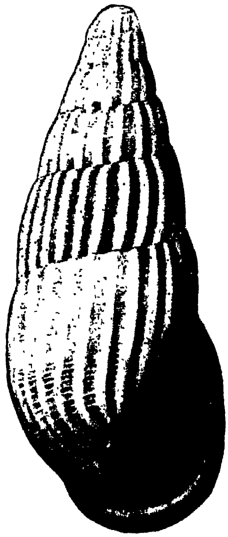
RECENT AND FOSSIL WEST AMERICAN RISSOINAS.

FOR EXPLANATION OF PLATE SEE PAGE 61.



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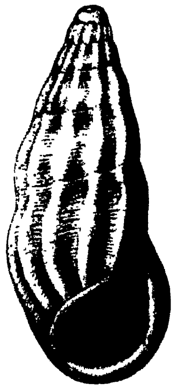

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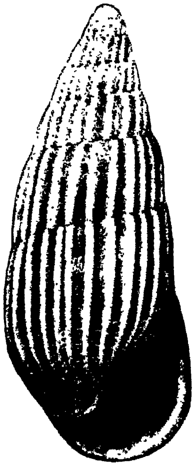

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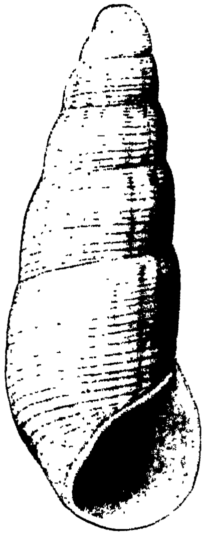

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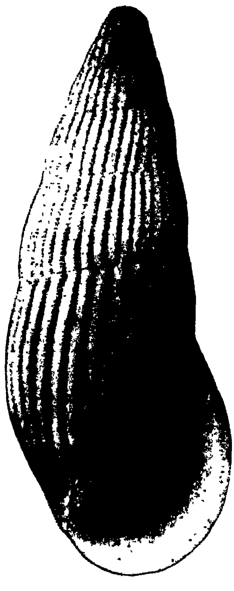

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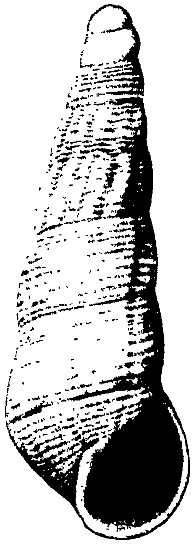

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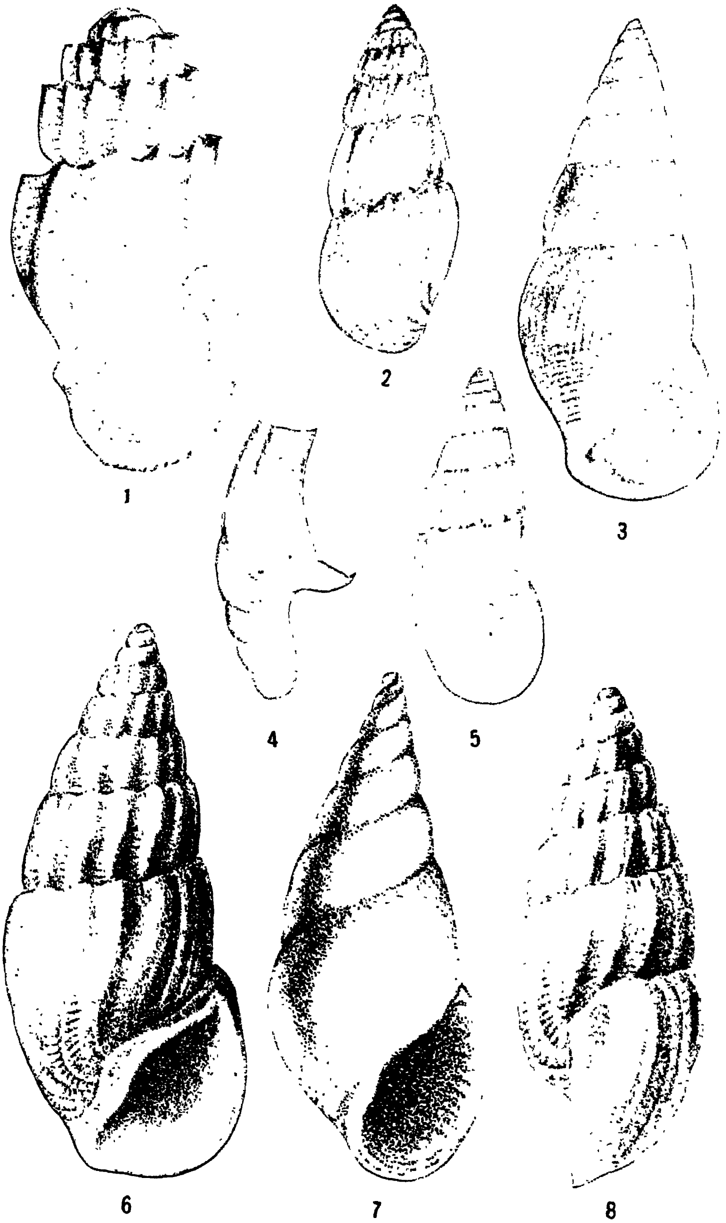
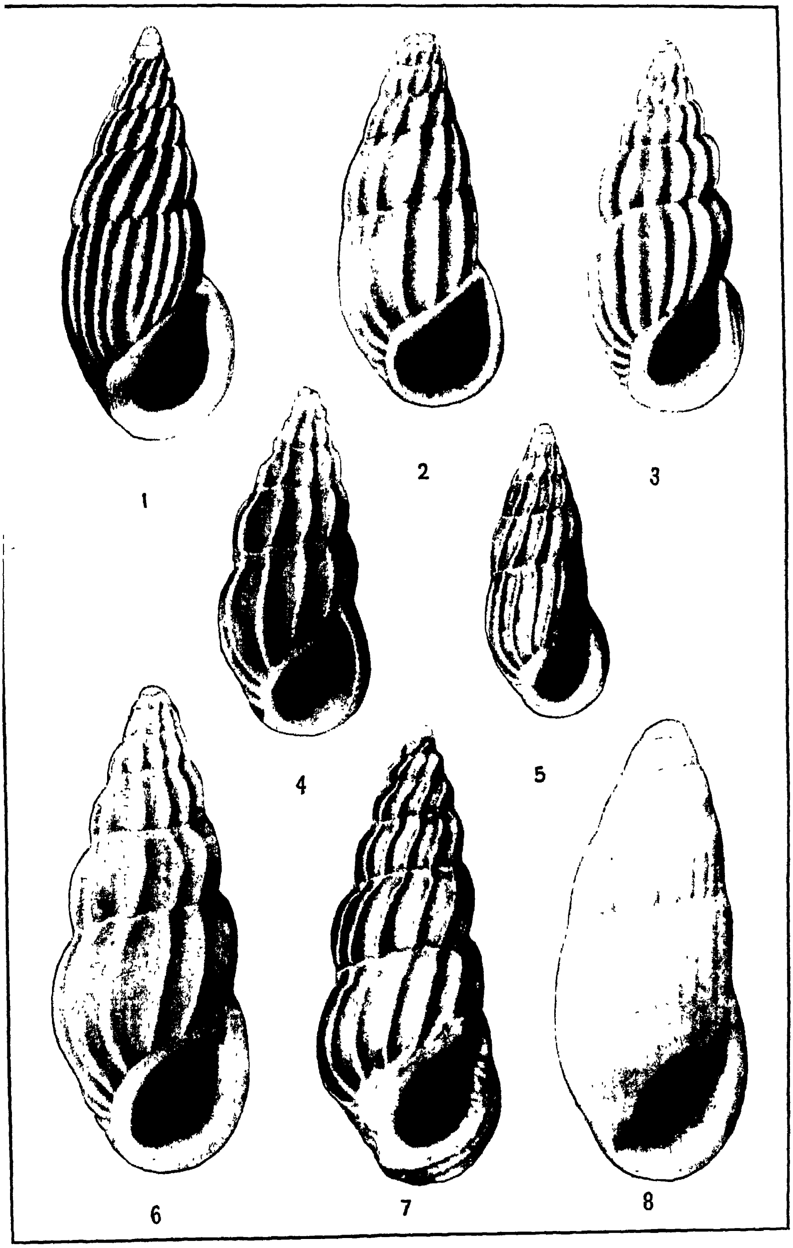
RECENT AND FOSSIL WEST AMERICAN RISSOINAS.

FOR EXPLANATION OF PLATE SEE PAGE 62.



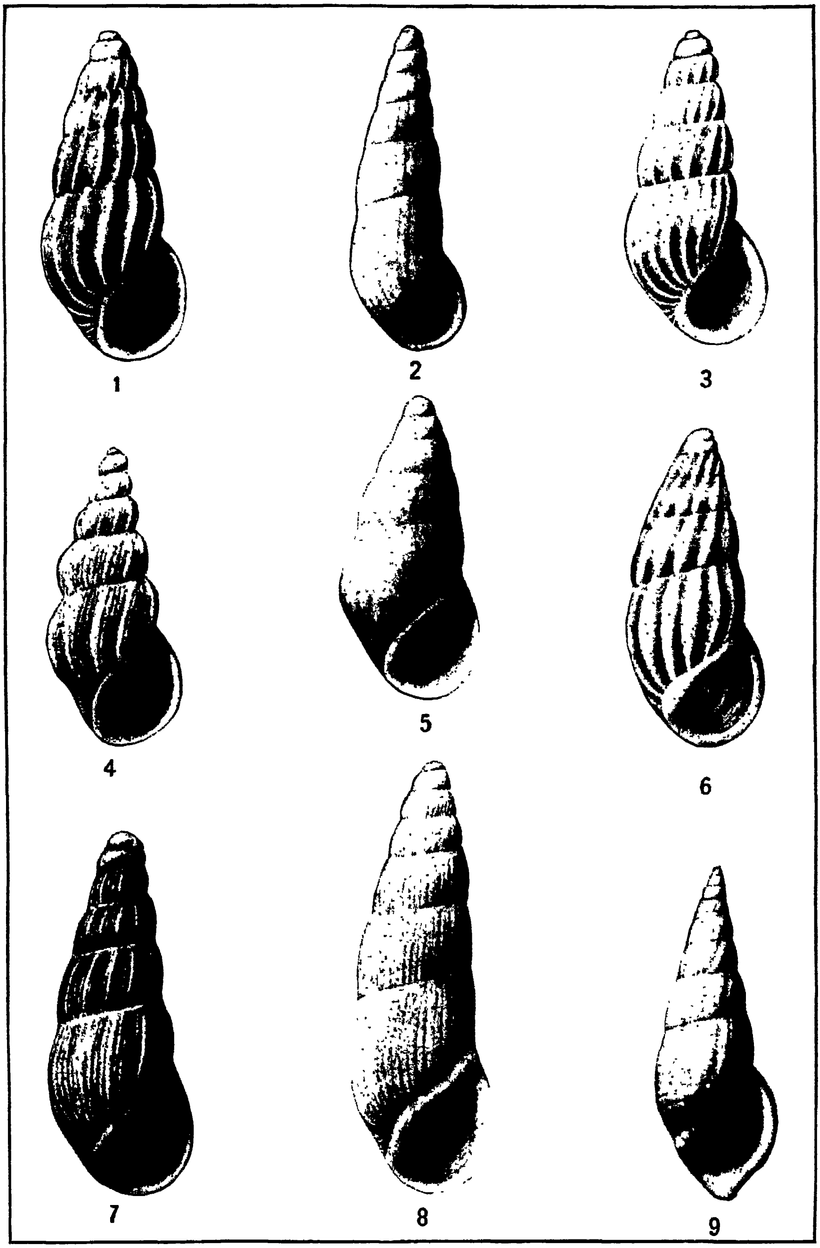
RECENT AND FOSSIL WEST AMERICAN RISSOINAS.

FOR EXPLANATION OF PLATE SEE PAGE 62.



Recent and Fossil West American Rissoinas.

For explanation of plate see page 62.



RECENT AND FOSSIL WEST AMERICAN RISSOINAS.

FOR EXPLANATION OF PLATE SEE PAGE 62.

A REVISION OF THE NORTH AMERICAN ICHNEUMON-FLIES OF THE SUBFAMILY OPIINAE.

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It is the intention to present, in the following pages, a synoptic revision of the Braconid subfamily Opiinae for North America, including only those Mexican and West Indian species the types or paratypes of which are in the United States National Museum. Keys to genera and species are accompanied by descriptions of nineteen new species, together with some notes on described forms.

With the exception of seven species described by H. L. Viereck, the types of which are in the Snow collection at the University of Kansas and not obtainable, type or paratype specimens of all the described species have been studied. Through Prof. S. J. Hunter, entomologist of Kansas University, notes on the Viereck types were obtained which, together with the original descriptions, have permitted the placing of these species in the keys.

Thanks are due and are cheerfully accorded to the Rev. V. A. Huard, of the Provincial Museum, Quebec, Canada, for the loan of the Provancher types, and to Prof. S. J. Hunter for the notes already referred to.

Superfamily ICHNEUMONOIDEA.

Family BRACONIDAE.

Subfamily OPIINAE.

1862. *Opioidae* Foerster, family 24, Verh. d. Naturh. ver-Preuss. Rheinl., vol. 19, pp. 229, 258.
1885. *Opiides* Marshall, Trans. Ent. Soc. London, p. 11.
1887. *Opiinae* Cresson, Syn. Hym. North America, pp. 56, 61.
1888. *Opiidae* Marshall, Spec. d. Hym. d. Eur., vol. 4, p. 67.
1901. *Opiinae* Ashmead, Proc. U. S. Nat. Mus., vol. 23, pp. 112, 133.
1904. *Opiinae* Szepligeti, Wytsman's Genera Insectorum, Braconidae, pp. 5 and 158.

Head transverse; occiput (except in the genus *Ademon*) never completely margined though usually margined at the sides; mandibles crossing at the tips and bi-dentate at apex; clypeus either fitting

PROCEEDINGS U. S. NATIONAL MUSEUM, VOL. 49—NO. 2095.

close to the mandibles or arcuated anteriorly leaving a transverse, elliptical opening between; antennae filiform. Thorax rather short and robust, the parapsidal grooves present or absent; anterior wings with three cubital cells, radial cell complete (open in the genus *Ademon*) and terminating at or somewhat before the wing apex though never shorter on the anterior margin of the wing than the length of the stigma, submedian cell usually a little longer than the median cell, anal cell never divided by a transverse nervure; posterior wing with the radius usually effaced, the submedian cell as measured on the median nervure at least one-third the length of the median. Legs normal, the posterior tibial spurs short. Abdomen inserted between the posterior coxae, subsessile or subpetiolate, usually shorter than the combined head and thorax, ovate or elliptical, the apical segments often somewhat retracted in the female; ovipositor variable, more often concealed or very short but frequently as long as the abdomen or even longer.

Many Opiinae are not readily separated from some of the smaller Braconinae while others can easily be mistaken for small Alysiids. They can be distinguished from Braconines, however, by the longer submedian cell of the hind wing and the slightly different character of the opening between the clypeus and mandibles. From Alysiids they may always be distinguished by the mandibles.

The group offers a few good characters for the separation of species but does not yield itself readily to separation into well-defined genera. Many of the recorded genera are based upon trivial and unreliable characters which make their retention impossible.

American writers have confined themselves almost entirely to descriptions of isolated species in this group. Dr. W. H. Ashmead has given a generic synopsis in his Classification of the Ichneumon-Flies which is, however, largely a translation from Foerster. Cresson, Provancher, Ashmead, Viereck, and the writer have published descriptions of species. Of those described by Provancher, only four species are properly placed in Opiinae. Several of Ashmead's species also prove to belong in other groups of the Braconidae while four species described by him as Alysiids are really Opiines.

A number of forms are known to the writer, descriptions of which are not included in this paper for the reason that they are represented only by imperfect specimens or specimens accompanied by insufficient data.

Species of Opiinae have been recorded as parasitic on Dipterous, Coleopterous, and Lepidoperous insects. The usual hosts are phytophagous Diptera, belonging to the families Agromyzidae, Trypetidae, Anthomyidae, and related families, but there can be little doubt that some species do attack Lepidopterous leaf-miners. That any are parasitic on Coleoptera remains to be proven.

Silvestri's observations on the parasites of African fruit flies[1] and my own experience indicate that the egg of the parasite is apparently in all cases deposited in or upon the host larva in one of its immature stages. In all instances observed, the host larva completed its development and assumed the pupal stage before being killed by the parasite. The parasitic larva then underwent its transformation in the puparium and emerged at about the time when the adult fly would have emerged.

BIBLIOGRAPHY OF THE GENERA AND THEIR SYNONYMY.

Ademon Haliday, Ent. Mag., vol. 1, 1833, p. 266.

Allotypus Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

Apodesmia Foerster, Vehr. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

Aulonotus Ashmead, Canad. Ent., vol. 32, 1900, p. 368=**Opius.**

Austroopius Szepligeti, Termes Fuzetek, vol. 23, 1900, p. 64.

Biophthora Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

Biosteres Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

Cephaloplites Szepligeti, Termes Fuzetek, vol. 20, 1897, p. 600.

Chilotrichia Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 258=**Opius.**

Cryptonastes Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Desmatophorus Thomson, Opus. Ent., 1895, p. 2194=**Opius.**

Desmiostoma Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Diachasma Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

Diachasmimorpha Viereck, Proc. U. S. Nat. Mus., vol. 44, 1913, p. 641=**Opius.**

Diraphus Wesmael, Nouv. Mem. Acad. Sc. Bruxelles, vol. 11, 1838, p. 89=**Gnamptodon.**

Eurytenes Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 259.

Eutrichopsis Foerster, Verh. Naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Giardinaia Perez, Zool. Jahrb. Syst., vol. 15, 1902, p. 631.

Gnamptodon Haliday, Ent. Mag., vol. 1, 1833, p. 265.

Hedylus Marshall, Trans. Ent. Soc. Lond., 1891, p. 16.

Holconotus Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

Hypocynodus Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Hypolabis Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Lytacra Foerster, Verh. Naturh. ver preuss. Rheinl., vol 19, 1862, p. 258=**Opius.**

Mesotages Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 258=**?Hedylus.**

Nosopoea Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Opiellus Ashmead, Can. Ent., vol. 32, 1900, p. 368=**Opius.**

Opius Wesmael, Nouv. Mem. Acad. Sc. Bruxelles, vol. ?9, 1835, p. 115.

Phaedrotoma Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**

Rhabdospilus Thomson, Opus. Ent., 1895, p. 2198=**Opius.**

Rhabdospilus Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**

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[1] Bull. No. 3, Div. of Ent. Hawaiian Board of Agriculture and Forestry.

Rhinoplus Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 258.
Stenospilus Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 259=**Opius.**
Stiropius Cameron, Journ. Roy. Agri. and Com. Soc. British Guiana, 1911, p. 329.
Sulydus Buysson, Ann. Soc. Ent. Fr., 1897, p. 354.
Therobolus Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 260=**Opius.**
Trichopius Thomson, Opus. Ent., 1895, p. 2176=**Opius.**
Trigonospilus Ashmead, Proc. U. S. Nat. Mus., vol. 23, 1901, p. 134=?**Opius.**
Utetes Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 261=**Opius.**
Zetetes Foerster, Verh. Naturh. ver preuss. Rheinl., vol. 19, 1862, p. 258=**Opius.**

The treatment of the genera as given here does not differ radically from that by Szepligeti except that the genera *Biosteres* and *Diachasma* are combined with *Opius*. After a careful study of all the available material, including a number of European species, the writer is convinced that it is impossible to point out any character or group of characters that will always separate these groups. The extremes of the genus *Opius* as thus constituted appear at first glance to be quite different insects, but there is such a perfect gradation and duplication of characters from one type to the other that I am compelled to believe that they should constitute but one genus. The name *Biosteres* has been shown by Viereck[1] to be isogenotypic with *Opius* Wesmael, and to attempt to retain the old grouping would necessitate changing the generic names of the majority of described Opiinae.

Stiropius is a genus described by Cameron from South America since the publication of Szepligeti's monograph.

Giardinaia, described by De Stefani Perez, is too insufficiently characterized to permit of its being placed in the key. It may or may not be an Opiine.

Diaschasmimorpha Viereck, described from India, can not be distinguished from Opius as here defined.

Trigonospilus Ashmead, the type of which has not been located, is believed also to be an Opius.

Key to the genera.

1. Occiput completely margined; radial nervure effaced before attaining the wing margin; body rugulosely sculptured .... *Ademon* Haliday.
   Occipital carina incomplete; radial nervure attaining the wing margin; body usually smooth and polished .... 2.
2. Suturiform articulation deep, foveolate, and strongly arched, the convexity of the arch toward the apex of the abdomen; third tergite with an oblique furrow from the anterior middle to the lateral margins .... *Gnamptodon* Haliday.
   Suturiform articulation obsolete, or if defined, then straight, shallow, and not foveolate; third tergite without oblique furrows .... 3.
3. Clypeus three-toothed .... *Sulydus* Du Buysson.
   Clypeus not three-toothed .... 4.
4. Clypeus with a stout horn .... *Rhinoplus* Foerster.
   Clypeus without a horn .... 5.

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[1] Bull. 83, U. S. Nat. Mus., 1914, p. 21.

5. First and second abdominal tergites with a median carina; second abscissa of radius not longer than the second transverse cubitus.............. *Stiropius* Cameron.
   Second tergite always without a median carina; second abscissa of radius usually longer than the second transverse cubitus.................................... 6.
6. Face with two stout horns................................ *Cephaloplites* Szepligeti.
   Face without horns.. 7.
7. First cubital cross vein thicker than the other veins........ *Austroopius* Szepligeti.
   First cubital cross vein normal.. 8.
8. Radius arising from the extreme base of the stigma............. *Eurytenes* Foerster.
   Radius arising distinctly beyond the base of stigma........................... 9.
9. Abdomen subpetiolate, the first tergite at least three times as long as broad; subdiscoidal nervure arising from the upper angle of the second discoidal cell; second cubital cell short, the second radial abscissa scarcely longer than the second cubital crossvein... *Hedylus* Marshall.
   Abdomen subsessile or sessile, the first tergite not three times as long as broad; subdiscoidal nervure arising at or below the middle of the second discoidal cell; second abscissa of radius longer................................ *Opius* Wesmael.

Genus ADEMON Haliday.

This genus is characterized by the completely margined occiput, the open radial cell, and the rugulose sculpture of the body. The recurrent nervure joins the first cubital cell some distance before the basal nervure, the second abscissa of radius is about equal to the first cubital cross vein, and the stigma is rather long and narrow. Ashmead placed the genus in his tribe Rhyssalini, but both Marshal and Szepligeti have placed it with the Opiinae. The writer doubts its affinity with the Opiinae, but has included it here for want of a better understanding of its relationship.

ADEMON NIGER Ashmead.

Rhyssalus niger ASHMEAD, Bull. Ill. St. Lab. Nat. Hist., vol. 4, 1895, p. 276.

Male.—Length 2 mm. Head, thorax, and abdomen to apex of third segment finely coriaceous and opaque; head transverse narrowed behind, the posterior orbits receding and broader than the width of the eyes; face rugose, the clypeus smooth, less than twice as broad as long and applied close to the mandibles; occiput concave, the occipital carina prominent; vertex behind the ocelli with a small subtriangular smooth area bounded by sharp carinae; antennae very slender, 24-jointed, the first flagellar joint much longer than the second and following joints; mesoscutum with the parapsidal grooves effaced except anteriorly; mesopleurae with a crenulate impression below propodeum irregularly rugose with a median longitudinal carina; wings longer than the whole body, the stigma long and narrow; legs very long and slender; abdomen ovate, about as long as the head and thorax, its first tergite much wider at apex than at base; suturiform articulation distinct, the third segmnet not half as long as the second; apical segments smooth. Body color brownish-black; antennal pedicel, mandibles, all coxae, and all femorae yellow; apices of femorae, all tibiae, and all tarsi dark brown; antennae black; wing veins and stigma pale brownish.

Habitat.—Havana, Illinois.

Four specimens bearing Illinois State Laboratory of Natural History, No. 13068. According to Mr. C. A. Hart these specimens were taken by him September 23, 1894, on the shore of Quiver Lake, near Havana, Illinois, where they were found running about on the surface of duckweed (*Lemna*).

Genus GNAMPTODON Haliday.

This genus is like *Opius*, except that the second abscissa of radius is scarcely longer than the first abscissa, the second cubital cell very short, and the abdomen is quite different, the suture between the second and third tergites being deep, foveolate, and strongly arched, while the third tergite has an oblique furrow from the anterior middle to the lateral margins. The second tergite has a transverse, smooth, slightly raised area at base.

GNAMPTODON NEPTICULAE Rohwer.

Plate 34, fig. 1; plate 35, fig. 13.

Gnamptodon nepticulae ROHWER, Proc. U. S. Nat. Mus., vol. 49, 1915, p. 229.

Habitat.—Virginia.

Host.—*Nepticula castaneaefoliella.*

Genus OPIUS Wesmael.

The genus is sufficiently characterized in the description of the subfamily and the generic key. As here constituted the genus includes the vast majority of the American species of Opiinae.

Key to the species of Opius.

1. Second abscissa of radius shorter or scarcely longer than the first cubital cross vein .... 2.
   Second abscissa of radius longer than the first cubital cross vein .... 11.
2. Mesopleurae striate, the striae arcuately curving from the superior to the posterior margin; abdominal tergites wrinkled .... *secundus* Viereck.
   Mesopleurae not striate; abdominal tergites not all wrinkled .... 3.
3. Dorsum of the mesothorax granularly sculptured; first transverse cubitus nearly obsolete; parapsidal grooves impressed and terminating posteriorly in a striate area; first and second abdominal tergites and basal border of the third striate. *appalachicolus* Viereck.
   Dorsum of the mesothorax smooth; first transverse cubitus distinct; parapsidal grooves incomplete and rarely terminating in a striate area; first and second tergites sometimes striate .... 4.
4. Malar space longer than the width of a mandible at base .... 5.
   Malar space shorter than the width of a mandible at base .... 10.
5. Posterior wing with a distinct postnervellus;[1] ovipositor strongly exserted .... 6.
   Posterior wing without a distinct postnervellus; ovipositor short .... 8.

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[1] The name postnervellus is applied to a crossvein or stub of a vein, interstitial with the basal nervure in the posterior wing, and extending backward toward the posterior margin of the wing, parallel with the nervellus.

6. Second tergite striate; wings hyaline........................*melleus*, new species.
   Second tergite smooth; wings blackish or fuscous.............................. 7.
7. Clypeus anteriorly produced medially into an obtuse angle; mesopleural impression smooth..*crawfordi* Viereck.
   Clypeus anteriorly truncate or only slightly rounded; mesopleural impression crenate...*sanguineus* Ashmead.
8. Mesopleurae with a crenate impression.. 9.
   Mesopleural impression smooth...................................*kukakense* Ashmead.
   also *indotatus* Viereck.
9. First abscissa of radius almost as long as the second and nearly half the length of the transverse cubitus; parapsidal grooves impressed to the middle of the mesoscutum...*politus* Provancher.
   First abscissa of radius not half the length of the second and not more than one-third the length of the first cubital cross vein; parapsidal grooves effaced except at the anterior lateral angles of the mesoscutum..........*anthomyiae* Ashmead.
10. Mesopleural impression smooth; postnervellus absent; ovipositor scarcely exserted; color black..*foveolatus* Ashmead.
    Mesopleural impression crenate; postnervellus present; ovipositor longer than the abdomen; color stramineous.........................*ferrugineus*, new species.
11. Eyes small and nearly circular; malar space longer than the width of a mandible; mesopleural impression strongly crenate; mesoscutum without an impression medially in front of the scutellum; second tergite striate; ovipositor nearly as long as the abdomen; length, 4.25 mm.; head, tegulae, legs, and abdomen beneath pale yellow; rest of body black.................*flaviceps*, new species.
    Eyes distinctly oval; malar space shorter than the width of a mandible, or, if longer, then not combining all of the above characters..................... 12.
12. Eyes distinctly diverging below and unusually large; ocell-ocular line hardly twice as long as the greatest diameter of an ocellus; malar space about half as long as the width of a mandible; wings fuscous; ovipositor about half the length of the abdomen; body-color testaceous; head and legs blackish.
    vierecki, new species.
    Eyes not especially large and not diverging below; ocell-ocular line usually distinctly more than twice as long as the diameter of an ocellus; if shorter, then not combining all of the above characters................................. 13.
13. Ovipositor as long as the body; posterior orbits about as broad as the diameter of the eye; clypeus and mandibles hardly separated; mesopleural impression smooth; mesoscutum without a median impression; antennae inserted about the middle of the eyes, 47-jointed; hind tibiae, all tarsi, the eyes and ocelli black; rest of the body pale testaceous...........*brunneitarsis*, new species.
    Ovipositor much shorter; otherwise not combining all of the above characters.. 14.
14. Head unusually thick antero-posteriorly, apparently not more than twice as broad as long as seen from above; posterior orbits broad and only slightly sloping; broad opening between mandibles and clypeus; mesoscutum without a median impression; mesopleural impression smooth; ovipositor half as long as the abdomen; head and thorax black; legs and abdomen testaceous; length 3.5 mm...*crassiceps*, new species.
    Head more transverse, appearing more than twice as broad as long; orbits sometimes broad but usually more sloping; otherwise not combining all of the above characters.. 15.
15. Second abdominal tergite sculptured; suturiform articulation usually evident. 47.
    Second tergite smooth; suturiform articulation usually obsolete.............. 16.
16. Parapsidal grooves complete; antennae ringed with white.................... 17.
    Parapsidal grooves incomplete; antennae not ringed with white............. 18.

17. General color reddish yellow; recurrent nervure joining the first cubital cell; antennal joints 16–19 inclusive white .... *ashmeadi* Dalle Torre.
General color black; recurrent nervure joining the second cubital cell; antennal joints beyond the 14th to the apex white, the two apical joints fuscous.
cincticornis, new species.
18. Mesoscutum with a median dimple-like impression or longitudinal slit in front of the scutellum .... 19.
Mesoscutum without a median impression .... 32.
19. Mesopleurae with a crenulate or foveolate impression below the middle...... 20.
Mesopleural impression smooth or absent .... 28.
20. Mandibles and clypeus fitting close together, without a distinct opening between .... 27.
Mandibles and clypeus separated by a distinct opening..................... 21.
21. Median impression on the mesoscutum slit-like, extending to or beyond the middle of the mesoscutum; yellowish species.......................... 22.
Median impression on the mesoscutum not extending forward to the middle of the mesoscutum; (blackish species except *anastrephae*) .... 23.
22. Forewing from its base to apex of stigma fuscous; ovipositor nearly half as long as the abdomen ....*fuscipennis*, new species.
Forewing not fuscous; ovipositor short ....*canaliculatus*, new species.
23. Ovipositor nearly half as long as the abdomen; body color uniformly stramineous..*anastrephae* Viereck
Ovipositor scarcely exserted; not uniformly stramineous.................... 24.
24. Head, except a spot surrounding the ocelli, yellow; antennae inserted about the middle of the eyes ....*provancheri* Dalle Torre.
Head blackish; antennae inserted a little above the middle of the eyes........ 25.
25. General color piceo-succineus, the head above, dorsum of the mesothorax, and apex of abdomen brownish or piceus; length about 2 mm..*succineus* Gahan.
Head and thorax polished black .... 26.
26. Abdomen except the first tergite yellow ....*brunneiventris* Cresson.
Abdomen except the second tergite black ....*cinctus* Provancher.
27. Mandibles with a distinct tooth on the ventral margin near the base.
mandibularis, new species.
Ventral margin of the mandibles without a distinct tooth....*utahensis* Gahan.
28. Mandibles with a distinct notch or tooth on the ventral margin near the base.. 29.
Ventral margin of the mandibles without a notch or tooth at base .... 31.
29. Propodeum not coarsely rugose, more or less shining; stigma long and narrow; median impression on the mesonotum very slight, almost obsolete; first tergite nearly twice as long as broad and distinctly striate; first abscissa of radius rather long ....*amplus* Ashmead.
Propodeum rather coarsely rugose; stigma subtriangular; median impression on the mesonotum deep and distinct... 30.
30. Length 3.5 mm...*basiniger* Viereck.
Length 2.75 mm.....................................*foersteri*, new species.
31. Sides of the thorax and more or less of the dorsum brown or castaneous; tegument surrounding the median impression on the mesoscutum rugulose.
nigrocastaneous Viereck.
Thorax wholly black; mesoscutum wholly smooth....*coloradensis*, new species.
32. Recurrent nervure joining the first cubital cell; mesoscutum conspicuously hairy all over .... 33.
Recurrent nervure interstitial or joining the second cubital cell; mesoscutum not conspicuously hairy.. 34.

33. Propodeum with a median longitudinl carina; mesopleurae above the crenate impression smooth.................................*rufocinctus*, new species.
Propodeum without a median carina; mesopleurae above the crenate impression distinctly reticulated.................................*apicalis*, new species.
34. Mesopleural impression crenate or foveolate.................................35.
Mesopleural impression smooth.................................43.
35. Head above, sides of thorax, and propodeum dark castaneous; face yellowish; propodeum nearly smooth; antennae 24-jointed in the male type.
tibialis Ashmead.
Head differently colored; thorax either wholly black or wholly pale yellow; propodeum usually rugose though not always.................................36.
36. Uniformly pale yellow species.................................42.
Black species, the head and abdomen sometimes marked with yellowish......37.
37. Head with the face and orbits, at least, yellow.................................38.
Head black or with only the lower part of face yellowish.................................39.
38. Mandibles fitting close to the clypeus; mesopleural impression only slightly rugulose.................................*luteiceps* Viereck.
Mandibles and clypeus separated by a distinct opening; mesopleural impression strongly crenate.................................*aberrans* Viereck.
39. Length about two and one-half millimeters; propodeum rugose all over; antennae 29-jointed in the type.................................*unifasciatus* Ashmead.
Length about one and one-half millimeters; propodeum not entirely rugose, more or less shining, and indistinctly sculptured or smooth.................................40.
40. Second abscissa of radius more than twice as long as the first transverse cubitus; propodeum smooth; first tergite nearly smooth and dark red or piceus in color; second tergite piceus.................................*montanus* Ashmead.
Second abscissa of radius distinctly less than twice as long as the first transverse cubitus; propodeum not wholly smooth.................................41.
41. First tergite granularly sculptured and pale yellow; second tergite also pale yellowish.................................*dimidiatus* Ashmead.
First tergite not granularly sculptured, black; second tergite blackish.
tantillus Ashmead.
42. Face practically smooth; recurrent nervure interstitial; antennae in the female type 29-jointed.................................*interstitialis* Ashmead.
Face rugulose; recurrent nervure joining the lower angle of the second cubital cell; antennae in the female type 24-jointed.................................*insularis* Ashmead.
43. Mandibles with a distinct notch or tooth on the ventral margin near the base; radial cell short and broad, terminating much before the extreme wing-apex.
ehrhorni, new species.
Mandibles without a tooth or notch on the ventral margin; radial cell terminating only a little above the extreme wing-apex.................................44.
44. Color testaceous or stramineous.................................45.
Color black.................................46.
45. Propodeum polished, smooth.................................*commodus*, new species.
Propodeum opaque, rugose.................................*diastatae* Ashmead.
46. Propodeum and first tergite smooth; mesopleural impression absent or nearly so; legs fuscous, their coxae blackish.................................*bruneipes* Gahan.
Propodeum rugulose laterally and posteriorly; mesopleural impression present but smooth; legs including coxae pale.................................*aridis* Gahan.
47. Face granularly rugulose; malar space distinctly longer than the width of a mandible at base.................................*salvini* Ashmead.
Face not granularly rugulose; malar space not distinctly longer than the base of mandible.................................48.

48. Ovipositor about half as long as the abdomen; two diverging furrows on the second tergite prolonged nearly to the suturiform articulation..*melanocephalus* Ashmead.
 Ovipositor concealed or very short; diverging furrows on the second tergite impressed only at the base of the tergite.................................. 49.
49. Thorax depressed, flattened above, wider between the wings than high dorsoventrally; coalesced second and third tergites granularly sculptured from base to apex....................................*striativentris*, new species.
 Thorax not depressed nor flattened above, not broader between the wings than high; coalesced second and third tergites sculptured before the suturiform articulation and either smooth or sculptured behind...................... 50.
50. Coalesced second and third tergites sculptured from base to apex, or at least beyond the suturiform articulation; propodeum smooth or very finely rugulose.. 51.
 Coalesced second and third tergites smooth beyond the suturiform articulation; propodeum rugose all over... 53.
51. Propodeum smooth and polished; second tergite black or blackish.
suturalis Gahan.
 Propodeum finely rugulose at least laterally and posteriorly; second tergite yellowish.. 52.
52. Propodeum opaque, granularly punctate all over; coalesced second and third tergites wholly reddish stramineous, following segments only slightly darker; pleurae and propodeum reddish......................*gracillariae*, new species.
 Propodeum finely punctate laterally and posteriorly, more or less shining above; first tergite blackish; coalesced second and third tergites beyond the suturiform articulation black as are the following tergites; propodeum and pleurae black.
nanus Provancher.
53. Mandibles with the ventral margin complete; mesopleural impression crenulate.
oscinidis Ashmead.
 Mandibles with a deep notch or tooth on the ventral margin near the base; mesopleural impression smooth...........................*americanus*, new species.

OPIUS SECUNDUS Viereck.

Diachasma secunda VIERECK, Trans. Kansas Acad. Sci., vol. 19, 1905, p. 272.

The type of this species has not been seen by the writer and it may prove not to be an Opiine. The striate mesopleurae and the wrinkled abdominal tergites apparently distinguish it from any other species in our fauna.

Habitat.—Kansas.

Host.—Unknown.

OPIUS APPALACHICOLUS Viereck.

Diachasma appalachicola VIERECK, Trans. Kansas Acad. Sci., vol. 19, 1905, p. 273.

Type in the Snow collection and not examined. Apparently differs from all other species in the granularly sculptured dorsum of the thorax.

Habitat.—Kansas.

Host.—Unknown.

OPIUS MELLEUS, new species.

Female.—Length 3 mm. Antennae longer than the body, 43-jointed in the type, the first flagellar joint about equal to the scape; head transverse, the vertex smooth and shining; frons smooth and bare medially but with a few obscure punctures and fine hairs toward the eye margins; eyes broadly elliptical, very slightly narrowed below and wider than the posterior orbits; face below antennae punctate and hairy with a slight median ridge which terminates some distance above the clypeus; clypeus punctate, about twice as wide as long down the middle, fitting close to the mandibles, its anterior margin rounded. Thorax sparsely pubescent, the hairs thickest on the propodeum and mesosternum; mesoscutum polished, trilobed, the parapsidal grooves nearly complete to the median slit-like impression in front of the scutellum; mesopleurae with an impressed crenate area below, otherwise mostly smooth; propodeum irregularly rugose. Wings hyaline; stigma broad, the radius arising from about the middle of stigma and attaining the wing margin above the extreme wing-apex about the length of the second transverse cubitus; first abscissa of cubitus shorter than half the width of stigma, second abscissa about equaling the first transverse cubitus; recurrent nervure interstitial; posterior wing with a distinct postnervellus. Abdomen ovate, a little longer than the thorax; first tergite striate with strong lateral and sublateral carinae; second tergite smooth laterally but with the median area strongly striate from the base to the subobsolete sutariform articulation, third and following tergites smooth; ovipositor exserted the length of the body; eyes, ocelli, flagellum, and ovipositor sheaths black; apical two-thirds of the posterior tibiae, their tarsi, the apical joint of the median and anterior tarsi, and the wing veins and stigma dark brown; remainder of the body reddish stramineous.

Type-locality.—Mount Washington, New Hampshire.

Type.—Cat. No. 19356, U.S.N.M.

Described from one specimen. Ashmead's manuscript name is adopted.

OPIUS CRAWFORDI Viereck.

Diachasma crawfordi VIERECK, Proc. U. S. Nat. Mus., vol. 40, 1911, p. 181.

Diachasma crawfordi KEILIN and PICADO, Bull. Sci. France et Belg., 1913, vol. 47, No. 2, p. 203, pl. 1.

This is a large yellowish species easily distinguished from all others by the characters given in the table of species. There can be no doubt of the synonymy of the Keilin and Picado species with that of Viereck. The figure given by the former establishes the identity beyond question.

Habitat.—Mexico.

Host.—*Anastrepha striata.*

OPIUS SANGUINEUS Ashmead.

Plate 35, figs. 1*a*, 1*b*.

Phaedrotoma sanguinea ASHMEAD, Proc. U. S. Nat. Mus., 1888, p. 655.
Opius sanguinea (Ashmead) MARSHALL, Trans. Ent. Soc. Lond., 1891, p. 47.
Phaedrotoma sanguinea ASHMEAD, Insect Life, vol. 5, p. 135.

Habitat.—District of Columbia and Missouri.

Host.—*Trypeta electa.*

OPIUS KUKAKENSE Ashmead.

Desmiostoma kukakense ASHMEAD, Proc. Wash. Acad. Sci., vol. 4, 1902, p. 251.

Habitat.—Alaska.

Host.—Unknown.

OPIUS INDOTATUS Viereck.

Biosteres indotatus VIERECK, Trans. Kansas Acad. Sci., vol. 19, 1905, p. 273.

This species has not been recognized and it can not be separated from the foregoing species by the original description.

Habitat.—Kansas.

Host.—Unknown.

OPIUS POLITUS Provancher.

Plate 35, fig. 5.

Opius politus PROVANCHER, Nat. Canad., vol. 14, 1883, p. 16.
Opius politus PROVANCHER, Faun. Canad. Hymenop., 1883, p. 804.
Hedylus politus PROVANCHER, Add. Faun. Canad. Hymenop., 1888, p. 381.

Very similar to *anthomyiae* but differing in the characters made use of in the table of species.

Habitat.—Canada and New York.

Host.—Unknown.

OPIUS ANTHOMYIAE Ashmead.

Plate 35, fig. 6.

Opius anthomyiae ASHMEAD, Proc. U. S. Nat. Mus., 1888, p. 654.

Habitat.—Michigan.

Host.—A dipterous leaf-miner in dock.

OPIUS FOVEOLATUS Ashmead.

Plate 35, fig. 3.

Opius foveolatus ASHMEAD, Proc. U. S. Nat. Mus., 1888, p. 654.

A series of specimens of this species have been reared by the writer at College Park, Maryland, from leaves of *Chenopodium album*, mined by *Pegomyia*, sp.

Habitat.—Maryland and Iowa.

Host.—*Pegomyia*, sp.

OPIUS FERRUGINEUS, new species.

Female.—Length 2 mm. Antenna longer than the body, 34-jointed in the type, the first joint of the flagellum about equal to the scape, joints toward the apex only a little longer than wide; head transverse; eyes elliptical, very slightly narrowed ventrally, wider than the posterior orbits; vertex and frons polished, very sparsely hairy; face below antennae hairy, with sparse obscure punctures and a distinct median ridge from the antennal line to the clypeus; clypeus short, transverse, its anterior margin somewhat concave, leaving a wide opening between it and the mandibles. Thorax smooth, sparsely hairy, the hairs thickest on the propodeum and mesosternum; mesoscutum trilobed, the parapsidal grooves obsolete on the posterior half, a deep dimple-like fovea medially just in front of the scutellum; scutellum smooth; mesopleurae with a crenulate impression; propodeum rugose. Stigma of the forewing broad and triangular, the radius arising from about the middle; first radial abscissa about one-third as long as the stigma is wide; second abscissa very slightly longer than the first transverse cubitus; radial cell short, terminating above the extreme wing-apex a distance about equal to the combined first and second abscissae of radius; second cubital cell narrowed outwardly; recurrent nervure joining the second cubital cell close to the basal nervure. Abdomen ovate, not longer than the thorax, its first tergite slightly longer than broad, with sublateral carinae from base to apex, the posterior half of the tergite between the carinae rugulose; segments beyond the first smooth; ovipositor exserted about one and one-half times the length of the abdomen. Eyes, spot enclosed by the ocelli, and the flagellum black; scape and pedicel brown; posterior tibiae except basally, all of the posterior tarsi and the terminal joint of the median and anterior tarsi brownish; wing veins and stigma yellowish-brown; ovipositor sheaths blackish; remainder of the body stramineous.

Male.—Antennae thirty-nine jointed in the type; abdomen brownish on the dorsum and not so broad as in the female; otherwise essentially like the female.

Type.—Cat. No. 19357, U.S.N.M.

Described from a female and a male in the United States National Museum, bearing the number 18814, which is an accession number of the Illinois State Laboratory of Natural History. Mr. C. A. Hart, of the latter institution, kindly furnished the following information from their records: "Taken in sweepings along the shores of Lake Geneva, in Wisconsin, August 31, 1892."

OPIUS FLAVICEPS, new species.

Female.—Length 4.25 mm. Head transverse, a little wider than the thorax; face slightly hairy and indistinctly punctate, with a median ridge; clypeus truncate anteriorly, a little more than three times as wide as long down the middle and distinctly separated from the mandibles by a transverse opening; malar space slightly longer than the width of a mandible at base; eyes protruding and nearly circular; occipital carina strongly developed at sides of the head, absent behind the vertex; ocell-ocular line more than three times the diameter of an ocellus; mesoscutum polished, without a median impression posteriorly, the parapsidal grooves effaced except at the extreme anterior lateral angles; scutellum smooth; mesopleural impression broadly ovate and distinctly crenate; propodeum coarsely rugose; wings hyaline, the stigma broadly lanceolate; recurrent nervure joining the second cubital cell some distance below the basal nervure; first radial abscissa shorter than half the width of stigma, second abscissa slightly more than one and one-half times the length of the first transverse cubitus; radial cell long and terminating somewhat above the extreme wing-apex. Abdomen long-ovate, its first tergite not much longer than broad and coarsely longitudinally striate, with strong sublateral carinae originating near the lateral basal angles and curved inward; suturiform articulation evident, second tergite striate, broad lateral margins of the second tergite and the third and following tergites smooth; ovipositor exserted nearly the length of the abdomen. Head except eyes, a spot enclosed by the ocelli, and the apices of mandibles stramineous; scape stramineous; flagellum black; thorax and dorsum of abdomen black, the venter of abdomen yellowish; legs including coxae pale stramineous; wing veins and stigma dark brown.

Type.—Cat. No. 19358, U.S.N.M.

One female specimen labelled Iowa Exp. Sta., Accession Catalog 716. Mr. J. E. Guthrie, of the Iowa Agricultural College, informs me that under the above accession number appears the following data: "Taken at Ames, Ia., by C. P. Gillette, July 4, 1890, sweeping in fields and woods."

OPIUS VIERECKI, new species.

Plate 34, fig. 2.

Female.—Length 4.5 mm. Head transverse, narrow antero-posteriorly, the posterior orbits above narrow and sloping; eyes very large; face smooth with a median ridge from the antennae to the clypeus; clypeus smooth, nearly four times as broad as long down the middle, separated from the mandibles by a broad opening; antennae broken; mesoscutum and scutellum smooth, polished, the parapsidal grooves deeply impressed anteriorly, becoming indistinct on the disk of the mesoscutum; mesopleurae smooth with an impressed oval area below the middle which is not strongly crenulate; propodeum rugose with a transverse carinate line a short distance from the base and a median longitudinal carina before it to the base; the area behind the transverse carina is rugose medially with a large, shallow, subquadrate pit, smooth within, at each lateral posterior angle; metapleurae smooth with three more or less well defined large pits along the upper margin; stigma of the forewing broad, the radius arising a little before its middle; second abscissa of radius about one and one-half times the length of the first transverse cubitus; first abscissa of radius less than the width of stigma; third abscissa curving slightly into the radial cell and attaining the wing margin only slightly above the extreme wing-apex; abdomen ovate, about as long as the thorax, its first tergite smooth with strong sublateral carinae from base to apex, and a median carina from about the middle to the apex; following tergites polished; ovipositor two-thirds the length of the abdomen. Head black, the clypeus and mandibles tinged with reddish; antennae black; thorax and abdomen dark stramineous; wings fuscous, the veins and stigma nearly black; all coxae and the posterior femorae concolorous with the thorax, rest of the legs dark reddish-brown.

Type-locality.—Cuernavaca, Mexico.

Type.—Cat. No. 19359, U.S.N.M.

Described from one specimen labeled U. S. Dept. Agri., No. 2089. This specimen was sent to the Department of Agriculture by Mr. Koebele along with a lot of (*Diachasma*) *Opius crawfordi* and is possibly a parasite of *Anastrepha striata.*

OPIUS BRUNNEITARSIS, new species.

Female.—Length 5 mm. Head transverse, polished, the face impunctate or nearly so, the clypeus with some large punctures; face with a strong median ridge; posterior orbits nearly as wide as the eyes; mandibles and clypeus hardly separated, the latter about two and one-half times as broad as long down the middle; malar space about equal to the width of a mandible at base; ocell-ocular line more than three times the diameter of an ocellus; thorax smooth and polished, the parapsidal grooves nearly obsolete on the posterior half of the mesoscutum, which is without a median impression in front of the scutellum; mesopleural impression smooth; propodeum rugose laterally, nearly smooth medially; metapleurae smooth; first abdominal tergite slightly longer than broad, rugoso-punctate between the sublateral carinae, nearly smooth along the lateral margins; following tergites smooth; ovipositor about as long as the abdomen. Wings slightly infuscated on the basal half; stigma long and not broad; first abscissa of radius about equal to half the width of stigma, second abscissa one and one-half times the length of the first tranverse cubitus. Eyes, ocelli, apices of mandibles, and antennae black; wing veins and stigma dark brown; all tarsi and the hind tibiae dark brown; remainder of body reddish stramineous.

Type.—Cat. No. 19360, U.S.N.M.

Described from a single specimen labeled Ames, Iowa, without further data.

OPIUS CRASSICEPS, new species.

Plate 34, fig. 3; plate 35, fig. 2.

Female.—Length 3.5 mm. Head transverse, smooth, more than usually thick antero-posteriorly; posterior orbits broad and only slightly receding, not as broad as the eyes; face impunctate or nearly so, the median ridge very slight and not reaching to the clypeus; eyes short oval; malar space equal to about two-thirds the width of a mandible at base; clypeus about three times as wide as long down the middle, the anterior margin rounded; opening between mandibles and clypeus broad; antennae 43-jointed, the first flagellar joint about three times as long as thick and scarcely longer than the second; ocell-ocular line equal to nearly three times the diameter of an ocellus; thorax smooth; parapsidal grooves effaced except at the lateral anterior angles of the mesoscutum; mesopleurae, smooth without an impression below the middle; propodeum rugose. Forewing with the first radial abscissa equal to about half the width of stigma, the second abscissa more than one and one-half times the length of the first transverse cubitus; recurrent nervure interstitial; second cubical cell much narrower at apex than at base; stigma not broad. First abdominal tergite rugose, the following segments smooth; ovipositor exserted a little less than half the length of the abdomen. Head and thorax black, mandibles rufous with their apices black; scape rufous, flagellum black; sides of prothorax, legs including coxae, and the whole abdomen rufo-stramineous; ovipositor sheaths black; wings hyaline, veins and stigma dark brown.

Type-locality.—Colorado.

Type.—Cat. No. 19361, U.S.N.M.

Two specimens without further data.

OPIUS ASHMEADI Dalle Torre.

Opius annulicornis ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 136 (not Thomson).

Opius ashmeadii DALLE TORRE, Catalog. Hymenop., vol. 4, 1898, p. 59.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS CINCTICORNIS, new species.

Female.—Length 2.3 mm. Head a little more than twice as wide as long antero-posteriorly, smooth except the face, which is faintly wrinkled; face with a sharp median ridge; posterior orbits about half the width of the eye; ocell-ocular line about three times the diameter of an ocellus; clypeus about twice as broad as long down the middle and separated from the mandibles by a narrow transverse opening; malar space about equal to the width of a mandible at base; antennae 24-jointed in the type, the first flagellar joint about five times as long as thick and distinctly longer than the second; thorax smooth, the parapsidal grooves complete and deeply impressed throughout; mesopleural furrow crenate; propodeum rugose; stigma of the forewing broadly lanceolate; recurrent nervure interstitial; first abscissa of radius equal to about half the width of stigma; second abscissa a little more than one and one-half times the first transverse cubitus; radial cell extending to the extreme apex of wing. First abdominal tergite about one and one-half times as long as broad, broadening from base to apex and finely longitudinally striate; following tergites smooth; ovipositor very slightly exserted. Antennal joints beyond the fourteenth except the two apical ones white, scape testaceous, rest of the antennae brown; mandibles, palpi, and clypeus pale yellowish; face piceus; remainder of the head black; thorax black; legs, including coxae, pale stramineous; wings hyaline, veins and stigma pale brownish; abdomen mostly black, the second tergite stained with yellowish.

Type-locality.—Oswego, New York.

Type.—Cat. No. 19362, U.S.N.M.

Described from one specimen.

OPIUS FUSCIPENNIS, new species.

Female.—Length 3 mm. Head strongly transverse, mostly smooth, the face below antennae sparsely punctate, with a distinct median ridge; clypeus punctate, with the anterior margin nearly straight, about four times as broad as long down the middle and separated from the mandibles by a transverse opening; malar space shorter than the width of a mandible at base; posterior orbits about two-thirds the width of the eye; ocell-ocular line equal to nearly four times the diameter of an ocellus; antennæ 38-jointed in the type, inserted a little above the middle of the eyes, the joints unusually short, first flagellar joint a little more than twice as long as broad, those in the middle scarcely longer than thick. Thorax smooth; median impression of the mesoscutum slit like and extending two-thirds its length, parapsidal grooves deep anteriorly, but effaced before joining the median impression; mesopleural impression strongly crenate; propodeum rugose, with a more or less distinct irregular transverse raised line before the middle; first abscissa of radius equal to about two-thirds the width of stigma, which is broad; second abscissa of radius about one and one-third times the length of the first transverse cubitus; radial cell terminating somewhat above the extreme wing apex. Abdomen ovate; first tergite a little longer than broad and scarcely narrowed at base, with distinct sublateral carina and a slight median carina on the posterior half, the space between the sublateral carina elevated and rugose, the lateral margins of segment nearly smooth; tergites beyond the first smooth; ovipositor one-third the length of the abdomen. General color reddish stramineous; eyes, ocelli, antennae except scape, and ovipositor sheaths black; scape, apices of mandibles, and apical joint of all tarsi brownish; wings to or a little beyond the apex of stigma fuscous, hyaline at apex.

Male.—Essentially like the female.

Type-locality.—Carlinville, Illinois.

Type.—Cat. No. 19363 U.S.N.M.

The allotype is labeled Champaign, Illinois, and a paratype female Roslyn, Virginia. Host unknown. Ashmead's manuscript name is applied to the species. The type was collected by Chas. Robertson.

OPIUS CANALICULATUS, new species.

Female.—Length, 2.5 mm. Head strongly transverse, mostly smooth; frons faintly punctate laterally and the face more distinctly so, the latter with a strong median ridge; clypeus nearly four times as broad as long down the middle, with rather coarse sparse punctures, its anterior margin straight and separated from the mandibles by a rather broad opening; malar space equal to about two-thirds the width of a mandible at base; posterior orbits half the width of the eyes and distinctly receding; ocellocular line about three times the diameter of an ocellus; antennae inserted slightly above the middle of the eyes, 32-jointed in the type, the first flagellar joint about twice as long as thick, following joints shortening gradually; mesoscutum smooth, the median impression slitlike and extending forward to the middle of the mesoscutum, parapsidal grooves deeply impressed anteriorly but effaced on the posterior two-thirds; mesopleural impression deeply crenulate; propodeum rugose with a transverse irregular raised line or carina near the base; stigma of the forewing broad; first abscissa of radius equal to about half the width of stigma; second abscissa equal to about one and one-half times the first transverse cubitus; radial cell terminating slightly above the extreme wing apex; abdomen short, ovate; first tergite slightly longer than broad and a little wider at apex than at base, with a median carina on the apical half and with sublateral carinae, the space between the sublateral carinae elevated and rugulose, laterad of these carinae smooth; following tergites smooth; ovipositor slightly exserted. Eyes, antennae, most of the pro- and mesopleurae and the propodeum black; head, dorsum of the thorax, the first tergite, and the legs reddish testaceous;

tergites beyond the first paler; ovipositor sheaths black; wings hyaline.

Type-locality.—College Park, Maryland.

Type.—Cat. No. 19364 U.S.N.M.

One specimen, collected by the writer, July 11, 1911. Very similar to *fuscipennis* except for the hyaline wings.

OPIUS ANASTREPHAE Viereck.

Plate 35, fig. 4.

Opius (*Utetes*) *anastrephae* VIERECK, Proc. U. S. Nat. Mus., vol. 44, 1913, p. 563.

Habitat.—Porto Rico.

Host.—*Anastrepha*, sp.

OPIUS PROVANCHERI Dalle Torre.

Opius ruficeps PROVANCHER, Add. Faun. Can. Hym., 1886, p. 124 (not Wesmael).
Opius provancheri DALLE TORRE, Cat Hym., vol. 4, 1898, p. 64.

Habitat.—Canada and New York.

Host.—Unknown.

OPIUS SUCCINEUS Gahan.

Opius succineus GAHAN, Can. Ent., vol. 45, 1913, p. 149; Journ. Agri. Research, U. S. Dept. of Agr., vol. 2, 1914, pl. 4, fig. 3.

Habitat.—Indiana and Illinois.

Host.—*Agromyza parvicornis.*

OPIUS BRUNNEIVENTRIS Cresson.

Opius brunneiventris CRESSON, Trans Amer. Ent. Soc., vol. 4, 1872, p. 178.
? *Opius brunneiventris* (Cresson) PROVANCHER, Add. Faun. Can. Hym., 1888, p. 382.

Habitat.—Texas and ? Canada.

Host.—Unknown.

OPIUS CINCTUS Provancher.

Opius cinctus PROVANCHER, Add. Faun. Can. Hym., 1886, p. 124; 1888, p. 381.

Habitat.—Canada.

Host.—Unknown.

OPIUS MANDIBULARIS, new species.

Plate 34, figs. 4*a*, 4*b*; plate 35, fig. 9.

Female.—Length 2 mm. Head and thorax polished; head transverse, the face sparsely punctate with a median ridge; malar space less than the width of a mandible at base; clypeus with the anterior margin slightly rounded, about two and one-half times as broad as long down the middle and separated from the mandibles by only a very narrow transverse opening, if at all; mandible with a distinct tooth or notch on the ventral margin near the base; antennae 29-jointed in the type, inserted a little above the middle of the eyes, the first flagellar joint two and one-half times as long as thick; ocell-ocular line about 2½ times as long as the diameter of an ocellus; width of the posterior orbit about half that of the eye; mesoscutum with the parapsidal grooves impressed anteriorly for a short distance only; mesopleural impression deep and slightly crenulate; propodeum rugose. Stigma of the forewing narrow, lanceolate, with the radius arising distinctly before its middle; first abscissa of radius equal to about half the width of stigma; second abscissa more than one and one-half times the length of the first transverse cubitus. Abdomen ovate, its first tergite about as long as broad at apex and fully twice as broad at apex as at base; irregularly striate; following tergites smooth; ovipositor hardly exserted. Head, thorax, and first abdominal tergite black; antennal flagellum black; scape, pedicel, clypeus, mandibles, palpi, legs including coxae, and the tegulae pale stramineous; second tergite concolorous with the legs, the following tergites blackish or brownish; wings hyaline, the nervures and stigma dark brown; apical one-third of the hind tibiae and their tarsi as well as the apices of the middle and anterior tarsi brown.

Male.—Differs from the female only in the usual sexual characters.

Type-locality.—Washington, District of Columba.

Type.—Cat. No. 19365, U.S.N.M.

Nine specimens labeled "Ex. Agromyzid in leaves of Chrysanthemum, Sept. 7, 1913, Mary Faunce collector."

OPIUS UTAHENSIS Gahan.

Opius utahensis GAHAN, Can. Ent., vol. 45, 1913, p. 145; Journ. Agri. Research, U. S. Dept. of Agr., vol. 2, 1913, p. 29, pl. 5, fig. 2.

Habitat.—Utah.

Host.—*Agromyza parvicornis.*

OPIUS AMPLUS Ashmead.

Adelura ampla ASHMEAD, Bull. Colo. Biol. Assoc., vol. 1, 1890, p. 19.

Habitat.—Colorado.

Host.—Unknown.

OPIUS BASINIGER Viereck.

Opius basiniger VIERECK, Trans. Kans. Acad. Sci., vol. 19, 1905, p. 270.

The type of this species is in the Snow collection and has not been examined.

Habitat.—Kansas.

Host.—Unknown.

OPIUS FOERSTERI, new species.

Plate 35, fig. 7.

Opius mellipes (Provancher) ASHMEAD, in Insect Life, vol. 3, p. 59.

Female.—Length 2.75 mm. Head polished above, the face with setigerous punctures and a distinct median elevation; clypeus truncate anteriorly, more than three times as broad as long down the middle, with some large punctures; mandibles fitting close to the clypeus and with a distinct tooth on the ventral margin near the base; malar space shorter than the width of a mandible at base; posterior orbit slightly narrower than the width of an eye and rounded off behind; antennae broken but showing at least thirty joints in the type; thorax polished; parapsidal grooves effaced except for a short distance anteriorly; propodeum rugose; mesopleural impression smooth; wings hyaline; first radial abscissa short, the second much longer than the first transverse cubitus; radial cell terminating above the extreme wing apex. First abdominal tergite slightly longer than broad at apex and rugose; following tergites smooth; ovipositor barely exserted. Black; clypeus, mandibles, palpi, scape, pedicel, tegulae, legs, and abdomen, except the first tergite, which is black, pale testaceous; wing veins and stigma brownish testaceous.

Male.—Similar in all respects to the female.

Type-locality.—Kirkwood, Missouri.

Type.—Cat. No. 19366, U.S.N.M.

The female is described from a specimen reared by Miss Murtfeldt, September 25, 1881, and supposedly parasitic on *Eulia triferana* (=*Lophoderus incertana*). Ashmead determined this parasite as *Opius mellipes* Provancher and recorded the rearing as cited above. The allotype is a specimen from the Ashmead collection, the origin of which is unknown.

OPIUS NIGROCASTANEUS Viereck.

Opius nigrocastaneus VIERECK, Trans. Kans. Acad. Sci., vol. 19, 1905, p. 272.

Type in the Snow collection. The species is unknown to the writer.

Habitat.—Kansas.

Host.—Unknown.

OPIUS COLORADENSIS, new species.

Female.—Length, about 3 mm. Head transverse, smooth, polished; face with distinct sparse punctures and a prominent median ridge; clypeus coarsely punctate basally, truncate anteriorly, and about four times as wide as long down the middle; mandibles with the ventral margin complete, only slightly separated from the clypeus by a narrow transverse opening; malar space shorter than the width of a mandible at base; posterior orbits about two-thirds the width of the eyes; ocell-ocular line fully three times the greatest diameter of an ocellus; thorax smooth and polished; propodeum rugose; stigma of the forewing moderately broad and long; first abscissa of radius about equal to half the width of stigma; second abscissa nearly twice as long as the first transverse cubitus; recurrent nervure interstitial or nearly so; first abdominal tergite rugoso-striate, broader at apex than at base, without distinct sublateral carinae, but with a sharp carina originating at each basal lateral angle and meeting on the median line before the middle of the tergite; remaining tergites smooth; ovipositor hardly extending beyond the apex of abdomen. Head and thorax black; scape, mandibles, tegulae, legs including coxae, and the venter and sides of abdomen bright reddish stramineous; dorsum of abdomen reddish brown, the first tergite black; wings hyaline, the stigma yellowish, veins brownish.

Type-locality.—Colorado Springs, Colorado.

Type.—Cat. No. 19367, U.S.N.M.

One specimen collected in August by E. S. Tucker at 5,915 feet elevation.

OPIUS RUFOCINCTUS, new species.

Allotypus rufocinctus ASHMEAD, MS. in Ent. News, vol 16, 1905, p. 297.

Female.—Length 2.2 mm. Head strongly transverse; antennae broken in the type, the first flagellar joint about three times as long as thick; head above impunctate, the frons and vertex distinctly hairy laterally; face closely punctate and covered with long hairs; clypeus rounded on the anterior margin fitting close to the mandibles and scarcely twice as broad as long down the middle; ocell-ocular line about three times the diameter of an ocellus; posterior orbits much narrower than the eye; malar space not equal to the width of a mandible at base; mesoscutum faintly punctate and distinctly hairy, the parapsidal grooves almost wholly effaced; mesopleurae smooth except the impression which is ovate and crenulate; propodeum rugose with a distinct median carina; forewing considerably longer than the whole body, broad; radius arising from about the basal one-third of stigma which is not broad; first abscissa of radius shorter than half the width of stigma; second abscissa about one and two-thirds times the first transverse cubitus; second cubital cell narrowed toward the apex; recurrent nervure joining the first cubital cell about the length of the first abscissa of radius before the basal nervure; abdomen short, oval, not as long as the thorax, the apical segments retracted; first tergite striate, narrower at base than at apex, and a little longer than broad; following tergites smooth; ovipositor scarcely reaching beyond the apex of abdomen. Black; scape, pedicel, mandibles, except apices, palpi, clypeus, and all legs including coxae pale honey-yellow; flagellum brownish black; tips of mandibles and tarsal claws brown; apical one-third of hind tibae and their tarsi slightly fuscous; second abdominal tergite on basal half honey-yellow; ovipositor sheaths black.

Type locality.—Algonquin, Illinois.

Type.—Cat. No. 19368, U.S.N.M.

One specimen. Ashmead's manuscript name is adopted.

OPIUS APICALIS, new species.

Plate 35, fig. 8.

Female.—Length 2 mm. This species is exactly similar to the foregoing except in the following details: The propodeum is without a median carina; the mesopleura above the crenate impression is not smooth but faintly coriaceous; the first abdominal tergite is not black but reddish and the apical segments are sometimes mostly honey-yellow like the base of the second; antennae 33-jointed in the type.

Male.—Like the female except in the usual sexual characters.

Type locality.—Colorado.

Type.—Cat. No. 19369, U.S.N.M.

Four specimens without further data. This may prove to be but a variety of *rufocinctus*. Ashmead's manuscript name is adopted.

OPIUS TIBIALIS Ashmead.

Adelura tibialis ASHMEAD, Can. Ent., vol. 25, 1893, p. 79.

Male.—Head transverse polished, the face practically impunctate; eyes rather small, ovate, wider than the posterior orbits which are slightly narrower above than below; clypeus small, the anterior margin distinctly convex, about twice as broad as long, and separated from the mandibles by a transverse opening; malar space apparently about as long as the width of a mandible at base; first flagellar joint a trifle more than three times as long as thick; mesoscutum without a median impression posteriorly, the parapsidal grooves faintly indicated on the anterior half; mesopleural impression faintly crenulate; propodeum nearly smooth; first tergite rugulose, wider at apex than at base, and distinctly longer than wide; following tergites smooth.

Notes from the type. For additional details see the original description.

Habitat.—West Virginia.

Host.—Unknown.

OPIUS LUTEICEPS Viereck.

Opius luteiceps VIERECK, Trans. Kans. Acad. Sci., vol. 19, 1905, p. 271.

The species has not been recognized. The original description agrees well with *provancheri* but in that species there is a large fusiform median impression on the posterior half of the mesonotum which is apparently absent in *luteiceps*.

Habitat.—Kansas.

Host.—Unknown.

OPIUS ABERRANS Viereck.

Opius aberrans VIERECK, Trans. Kans. Acad. Sci., vol. 19, 1905, p. 271.

The type of this species has not been examined. A specimen from Onaga, Kansas, which agrees with the description is in the United States National Museum and the characters used in the table of species are taken from this specimen.

Habitat.—Kansas.

Host.—Unknown.

OPIUS UNIFASCIATUS Ashmead.

Opius unifasciatus ASHMEAD, Journ. Linn. Soc. Zool., vol. 25, 1894, p. 135.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS MONTANUS Ashmead.

Adelura montana ASHMEAD, Bull. Colo. Biol. Assoc., vol. 1, 1890, p. 19.

This species apparently differs from *dimidiatus* only in the following details: The propodeum is smooth and the first tergite is not granularly rugose but practically smooth; the legs and the first and second tergites are dark reddish instead of pale straw-colored; the second abscissa of radius is more than twice as long as the first transverse cubitus while in *dimidiata* it is distinctly less than twice as long. Notes from the type.

Habitat.—Colorado.

Host.—Unknown.

OPIUS DIMIDIATUS Ashmead.

Plate 35, fig. 11.

Adelura dimidiata ASHMEAD, Proc. U. S. Nat. Mus., vol. 11, 1888, p. 647.
Eutrichopsis agromyzae VIERECK, Proc. U. S. Nat. Mus., vol. 42, 1912, p. 622.
Opius (*Eutrichopsis*) *agromyzae* (Viereck) GAHAN, Can. Ent., vol. 45, 1913, p. 148.

Ashmead's type is identical in every respect with those of Viereck. The species is a common parasite of *Agromyza pusilla*, and it is altogether likely that the "Dipterous larva in a stem of cabbage" given by Ashmead as the host was this Agromyzid, as this fly has been reared from cabbage leaves by the writer at College Park, Maryland. The species can only be separated from *aridus* and *bruneipes* by the characters used in the key.

Habitat.—Maryland, Ohio, Indiana, South Dakota, Utah.

OPIUS TANTILLUS Ashmead.

Opius tantillus ASHMEAD, Trans. Ent. Soc. Lond., 1900, p. 294.

Habitat.—Grenada.

Host.—Unknown.

OPIUS INTERSTITIALIS Ashmead.

Opius interstitialis ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 135.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS INSULARIS Ashmead.

Opius insularis ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 185.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS EHRHORNI, new species.

Female.—Length about 2 mm. Head transverse, polished, the face shining with faint setigerous punctures; clypeus fully three times as broad as long down the middle, its anterior margin straight and separated from the mandibles by a very narrow transverse opening; malar space very short, not equal to more than half the width of a mandible at base; posterior orbits a little narrower than the width of the eyes; ocell-ocular line at least three times as long as the diameter of an ocellus; mandibles with a distinct notch on the ventral margin near the base; antennae inserted a little above the middle of the eyes, 23-jointed, the first flagellar joint slightly more than twice as long as thick, following joints subequal and a little less than twice as long as thick; face with a median ridge; thorax polished; parapsidal grooves absent except at the anterior lateral angles of the mesoscutum, the mesoscutum without a median impression; mesopleurae smooth, with a shallow smooth impression below the middle; propodeum rugose; stigma of the forewing moderately broad; first abscissa of radius equal to about half the width of stigma, arising much before the middle of stigma; second radial abscissa nearly twice the length of the first cubital crossvein; third abscissa about equal to the second abscissa and the second cubital crossvein combined, attaining the wing margin far above the extreme wing-apex; recurrent nervure joining the inner angle of the second cubital cell. Abdomen ovate, about as long as the thorax, its first tergite rugose, slightly longer than broad and a little wider at apex that at base; following tergites smooth; ovipositor very slightly exserted. General color black; mandibles, except apices, and the clypeus rugose; antennal scape piceus, flagellum black; legs including all coxae reddish testaceous; wings hyaline, the veins and stigma pale brownish; tegulae testaceous; abdomen beyond the first tergite reddish testaceous, more or less mixed with blackish.

Type-locality.—Mountain View, California.

Type.—Cat. No. 19370, U.S.N.M.

Host.—Unknown.

One specimen bearing the above locality label and a second label as follows: "Ehrhorn, Lot 2."

OPIUS COMMODUS, new species.

Male.—Length 1.5 to 1.75 mm. Head transverse, smooth; face practically impunctate; malar space shorter than the width of mandible; rather broad opening between mandibles and clypeus; posterior orbits rounded, about half the width of eye; ocell-ocular line about three times as long as the diameter of an ocellus; antennae 27-jointed in the type, the first flagellar joint more than three times as long as thick; antennae inserted above the middle of the eyes. Thorax smooth, the parapsidal grooves very short; propodeum smooth, polished; stigma of the forewing moderately broad, the radius arising before its middle; second abscissa of radius one-third longer than the first transverse cubitus; third abscissa of radius twice as long as the second and attaining the wing margin very slightly above the extreme wing apex; recurrent nervure joining the second cubital cell. First abdominal tergite rugose, following tergites smooth. Body color reddish stramineous; eyes black; flagellum blackish; wing veins and stigma brownish.

Type-locality.—St. Vincent Island, West Indies.

Type.—Cat. No. 19371, U.S.N.M.

Six male specimens collected by H. H. Smith. The species is like *interstitialis* Ashmead except for the smooth propodeum, nonfoveolated mesopleural impression and the noninterstitial recurrent nervure.

OPIUS DIASTATAE Ashmead.

Bracon diastatae ASHMEAD, Proc. U. S. Nat. Mus., 1888, vol. 11, p. 617.

Opius diastatae (Ashmead) GAHAN, Can. Ent., vol. 45, 1913, p. 150—(Ashmead) PHILLIPS, Journ. Agri. Res. U. S. Dept. Agri., vol. 2, p. 29, pl. 4, fig. 2.

Habitat.—Florida, Alabama, and Indiana.

Host.—*Agromyza parvicornis.*

OPIUS BRUNEIPES Gahan.

Opius bruneipes GAHAN, Can. Ent., vol. 45, 1913, p. 148.

Habitat.—Florida and Maryland.

Host.—*Agromyza pusilla.*

OPIUS ARIDIS Gahan.

Opius aridis GAHAN, Can. Ent., vol. 45, 1913, p. 147.

Habitat—Arizona.

Host.—*Agromyza pusilla.*

OPIUS SALVINI Ashmead.

Opius salvini ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 134.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS MELANOCEPHALUS Ashmead.

Opius melanocephalus ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 134.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS STRIATIVENTRIS, new species.

Plate 35, fig. 12.

Female.—Length 1.5 mm. Head strongly transverse and polished, the face practically impunctate and with only a very slight median ridge; malar space hardly half as long as the width of a mandible at base; clypeus about twice as broad as long down the middle; eyes large and converging slightly below; a broad opening between mandibles and clypeus, the former small and just crossing at the tips; ocell-ocular line equal to about twice the diameter of an ocellus; posterior orbits receding and about half as wide as the eyes; antennae 22-jointed in the type, the first flagellar joint about four times as long as thick. Thorax distinctly broader between the wings than high (dorso-ventrally), the mesonotum flattened, smooth, the parapsidal grooves indicated only anteriorly; mesopleurae smooth with an impression below which is faintly rugulose within; propodeum granularly rugose; stigma of the forewing lanceolate, emitting the radius near the basal one-third; first abscissa of radius shorter than the width of stigma, second abscissa about one and one-half times the first transverse cubitus, third abscissa fully two and one-half times the second and attaining the wing margin very slightly above the extreme wing apex. First abdominal tergite granularly rugulose, a little longer than broad and wider at apex than at base; second and third tergites granularly rugulose, the suturiform articulation deep and distinct except toward the lateral margins; fourth tergite finely striate; following tergites smooth; ovipositor projecting only slightly beyond the apex of abdomen. General color reddish stramineous; eyes black; spot surrounded by the ocelli, mesoscutum, and scutellum piceus; antennal flagellum dark brown; hind tibiae and their tarsi fuscous; wings hyaline, the stigma and veins brownish.

Male.—Antennae 23-jointed in the type. Otherwise as in the female.

Type-locality.—United States.

Type.—Cat. No. 19372, U.S.N.M.

One female and two male specimens in the National Museum from the Ashmead collection. The origin of these specimens is unknown.

OPIUS SUTURALIS Gahan.

Opius suturalis GAHAN, Can. Ent., vol. 45, 1913, p. 146.

Since the original description of this species which was from a male, a female has been received from Holtville, California, bred by V. L. Wildermuth under Webster No. 6158. This female agrees with the description of the male except that the rugulose sculpture on the second tergite extends almost to the apex of the segment. The ovipositor scarcely extends beyond the apex of the abdomen.

Habitat.—Arizona and California.

Host.—*Agromyza pusilla.*

OPIUS GRACILLARIAE, new species.

Bracon gracillariae Ashmead, MS, Insect Life, vol. 2, 1890, p. 349.

Female.—Length 1.3 mm. Head transverse, smooth and polished, the face nearly smooth and without a distinct median ridge; clypeus about twice as broad as long and separated from the mandibles by an elliptical opening; posterior orbits about half the width of the eyes and receding; malar space shorter than the width of a mandible at base; antennae broken, inserted slightly above the middle of the eyes, the first flagellar joint nearly four times as long as thick; mesoscutum smooth, the parapsidal grooves absent except at the anterior angles, without a median impression; mesopleurae smooth, the impression below the middle faintly crenulate; propodeum rugose; wing-stigma moderately narrow, emitting the radius at the basal one-third; first radial abscissa about half as long as the width of stigma; second abscissa about twice the length of the first cubital crossvein; third abscissa twice the length of the combined first and second abscissae, slightly curved into the radial cell and attaining the wing margin only a trifle above the extreme wing-apex. First, second, and third abdominal tergites granularly rugulose, the suturiform articulation distinct; second tergite longer than the third; following tergites smooth; ovipositor barely exserted. Head and thorax piceus; mandibles, palpi, scape, clypeus, legs including coxae, tegulae, metapleurae, most of the propodeum, and the first and second abdominal tergites pale stramineous; antennal flagellum dark brown, the basal joints slightly paler; apex of abdomen blackish; wings hyaline, the veins and stigma brownish yellow.

Type-locality.—Kirkwood, Missouri.

Type.—Cat. No. 19373, U.S.N.M.

Described from one specimen. The reference above cited states that the specimen was reared by Miss Murtfeldt from *Gracillaria desmodiella*. This record needs to be verified.

OPIUS NANUS Provancher.

Opius nanus Provancher, Add. Faun. Can. Hym., 1888, p. 382.

The type of this species is from California and is very similar to *gracillariae* but may be distinguished by the characters used in the key.

Habitat.—California.

Host.—Unknown.

OPIUS OSCINIDIS Ashmead.

Plate 35, fig. 10.

Rhyssalus oscinidis Ashmead, Proc. U. S. Nat. Mus., 1888, vol. 11, p. 630.

Eutrichopsis oscinidis (Ashmead) Viereck, Proc. U. S. Nat. Mus., vol. 44, 1913, p. 559.

Habitat.—District of Columbia and Indiana.

Host.—Dipterous leaf miner in *Plantago*.

OPIUS AMERICANUS, new species.

Male.—Length 2 mm. Head transverse, smooth, the face with a median ridge and nearly impunctate; clypeus about twice as broad as long, slightly rounded on the anterior margin and fitting close to the mandibles; mandibles with a distinct tooth on the ventral margin near the base; malar space a little shorter than the width of a mandible at base; eyes wider than the posterior orbits which are only slightly receding; ocellocular line about equal to twice the diameter of an ocellus; antennae inserted above the middle of the eyes, 27-jointed, the first flagellar joint nearly four times as long as thick. Thorax smooth; mesoscutum nearly devoid of pubescence, the parapsidal grooves absent except at the anterior angles where they are deeply impressed, median impression absent; mesopleurae smooth, with a smooth impression below the middle; propodeum rugose with an indication of a median carina basally; wings hyaline; the stigma lanceolate, emitting the radius distinctly before the middle; first radial abscissa equal to about half the width of stigma; second abscissa twice as long as the first transverse cubitus; third abscissa about one and one-half times the combined length of the first and second abscissae; recurrent nervure joining the second cubital cell; abdomen not longer than the thorax, ovate; first tergite rugose, considerably longer than wide at apex, and wider at apex than at base; suturiform articulation distinct, the surface before the fold, except a narrow lateral margin, rugose; beyond the fold to the apex of abdomen smooth and polished. General color black; scape, pedicel, mandibles, except at apex, palpi, tegulae, and legs, including all coxae, pale stramineous; face with a faint castaneous tinge; antennal flagellum brownish-black; wing veins and stigma brown, the veins at base of wing stramineous.

Type.—Cat. No. 19374, U.S.N.M.

Described from a single specimen in the United States National Museum bearing Illinois accession number 17216. Mr. C. A. Hart informs me that this number refers to the following data: Collected by C. A. Hart while ascending a lonely road through a forest leading up Bald Knob, one of the Ozark hills in southern Illinois.

NORTH AMERICAN SPECIES UNKNOWN TO THE WRITER.

OPIUS ATRICEPS Ashmead.

Opius atriceps ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 136.

The paratype specimen of this species in the United States National Museum, is imperfect, the wings having been lost. It appears to be a *Microbracon.* Owing to the doubtful identity of this specimen and the further fact that the type may be a different species the status of this species must remain in doubt until the type can be examined.

Habitat.—St. Vincent.

Host.—Unknown.

OPIUS GRENADENSIS Ashmead.

Opius grenadensis ASHMEAD, Trans. Ent. Soc. Lond., 1900, p. 294.

Apparently not represented in the United States National Museum.

Habitat.—Grenada.

Host.—Unknown.

OPIUS FORTICORNIS Cameron.

Opius forticornis CAMERON, Invert. Pacif., vol. 1, 1904, p. 51.

Habitat.—Nicaragua.

Host.—Unknown.

OPIUS IRRIDIPENNIS Cameron.

Opius irridipennis CAMERON, Invert. Pacif., vol. 1, 1904, p. 51.

Habitat.—Nicaragua.

Host.—Unknown.

SPECIES WRONGLY CLASSIFIED AS OPIINAE.

The following species, described as Opiines, have been found to belong in other groups.

Family BRACONIDAE.

Subfamily RHOGADINAE.

ONCOPHANES ATRICAUDUS Ashmead.

Gnamptodon atricaudus ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894. p. 133.

As represented by the paratype in the United States National Museum, this species is not an Opiinae. It runs to the genus *Oncophanes* in Szepligeti's classification of the Braconidae.

Subfamily EXOTHECINAE.

PHANOMERIS MELLIPES Provancher.

Opius pallipes PROVANCHER, Natur. Canad., vol. 12, 1880, p. 164; vol. 15, 1883, p. 16; Faun. entom. Canad. Hymen., 1883, pp. 511 and 804, fig. 55.

Opius mellipes PROVANCHER, Add. Faun. Canad. Hymen., 1886, p. 123; 1888, p. 381.

This species apparently resembles *P. dimidiatus* Nees as described by Marshall.[1] The first abdominal tergite is without a distinct median longitudinal carina and the ovipositor is apparently longer than in *dimidiatus*. No other representatives of the genus Phanomeris are recorded from North America so far as known.

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[1] Spec. Hymenop. Eur., vol. 4, 1888, p. 174, pl. 7, fig. 2.

Subfamily BRACONINAE.

MICROBRACON DORSATOR Say.

Opius variabilis PROVANCHER, Add. Faun. Canad. Hymen., 1888, p. 382.

MICROBRACON CANADENSIS Ashmead.

Opius canadensis ASHMEAD, Can. Ent., vol. 23, 1891, p. 4.

MICROBRACON REJECTUS Ashmead.

Opius rejectus ASHMEAD, Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 136.

The original description of this species states that the antennae of the female are 27-jointed and those of the male 21-jointed. The males of Opiinae usually have more joints in the antennae than the females or at least as many. The number of joints is variable in both sexes but rarely if ever to the extent indicated, at least in species having less than thirty joints. It seems certain that Ashmead has confused two species in this description. The male type in the United States National Museum is not an Opiinae but a Microbracon. The female is in London and may be an *Opius*. Since the male symbol is placed before that of the female in the original description, the writer has chosen the male specimen as the type of the species and transferred the name *rejectus* to *Microbracon*. In the United States National Museum are specimens of an *Opius* agreeing with Ashmead's description and these have been described in the foregoing pages under the name of *Opius commodus*. The specimen in the British Museum possibly should be referred to this species.

MICROBRACON NIGER Provancher.

Opius niger PROVANCHER, Add. Faun. Canad. Hymen, 1888, p. 381.

This species seems not to be referable to any of the known species of *Microbracon*. The following descriptive notes are from the type, a female, and will supplement Provancher's description: Head above smooth, polished; face very finely punctate with a sharp median ridge from just below the antennae to the clypeus; triangular area before the ocelli and above the antennae very finely punctate; first joint of the flagellum about as long as the scape; thorax smooth and polished, the parapsidal grooves complete but not deeply impressed; propodeum mostly smooth and polished with a very short median longitudinal carina at the apex, the apical third of the propodeum more or less aciculate-punctate, the aciculations most pronounced each side of the carina; abdomen with the tergites irregularly wrinkled and shining, the ovipositor exserted about the length of the abdomen.

ALLOBRACON, new genus.

Plate 34, figs. *5a*, *5b*.

Head transverse, smooth; eyes very large, protruding, very slightly emarginate opposite the antennae, the fascets rather coarse and elevated; malar space distinct, a little shorter than the width of a mandible at base; face about as wide as the transverse diameter of an eye; posterior orbits very narrow, rounded; ocell-ocular line hardly twice the greatest diameter of an ocellus; antennae slender, 26-jointed, the joints of flagellum subequal or shortening very slightly toward the apex and about three times as long as thick; pedicel about equal to the scape; parapsidal grooves nearly effaced, mesonotum faintly rugulose, scutellum smooth; mesopleurae smooth; propodeum smooth, with a distinct median carina and not sloping posteriorly, its apex nearly on a level with its base; wings hyaline, the stigma moderately broad, the radius originating before the middle of stigma; first abscissa of radius nearly equal to the width of stigma, second abscissa a little longer than the first transverse cubitus; recurrent nervure interstitial; median crossvein a trifle beyond the basal nervure; abdomen a little longer than the thorax, lanceolate, its first tergite twice as wide at apex as at base, rugulose but with a semicircular, slightly depressed, flattened, smooth area at apex which is bounded by a faint carinate line from one posterior lateral angle to the other; following tergites faintly wrinkled; ovipositor about half as long as the abdomen. Legs long and slender, the basal joint of posterior tarsi as long as the four following joints together.

This genus is apparently related to *Megalomum* Szeplegeti, but differs in having a distinct malar space. From *Curriea* Ashmead it differs in the less emarginate eyes, longer malar space, peculiar first tergite, and the immaculate wings.

Type of the genus.—Diachasma pilosipes Ashmead.[1]

Subfamily ICHNEUTINAE.

ICHNEUTES BICARINATUS Ashmead.

Opius bicarinatus Ashmead, Can. Ent., vol. 23, 1891, p. 4.

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[1] Journ. Linn. Soc. Lond. Zool., vol. 25, 1894, p. 137.

EXPLANATION OF PLATES.

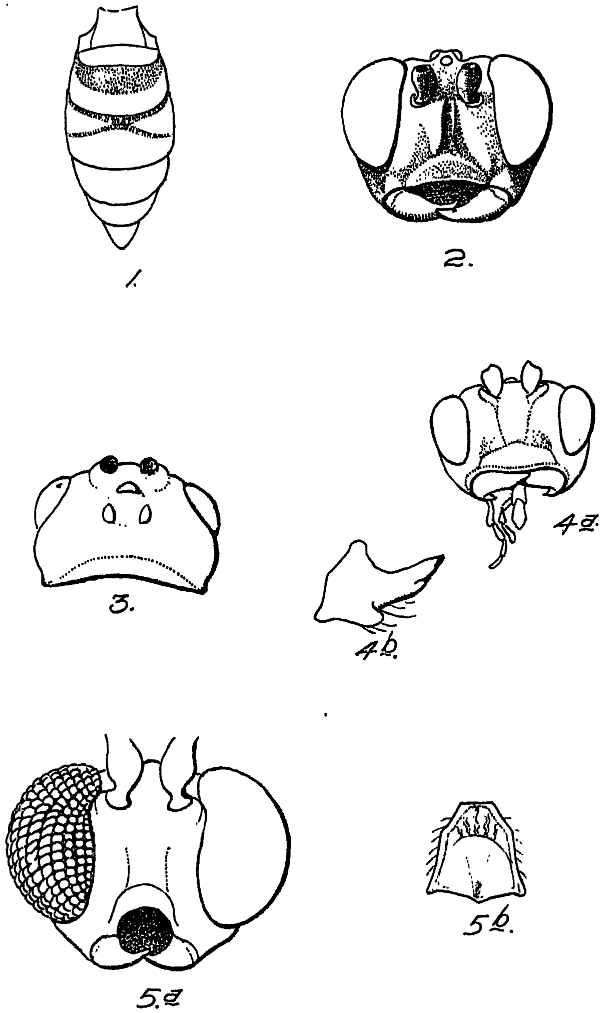
The drawings on Plate 34 are by Mr. W. R. Walton of the Bureau of Entomology. The wing figures on Plate 35 are from photographs by the writer. These photographs are not all on exactly the same scale. They are intended primarily to illustrate differences in wing venation.

PLATE 34.

Fig. 1. *Gnamptodon nepticulae.* Dorsal view of the abdomen.
2. *Opius vierecki.* Front view of the head.
3. *Opius crassiceps.* View of the head from above.
4. *Opius mandibularis.* (*a*) Front view of the head. (*b*) Left mandible.
5. *Allobracon pilosipes.* (*a*) Front view of the head. (*b*) Dorsal view of the first abdominal segment.

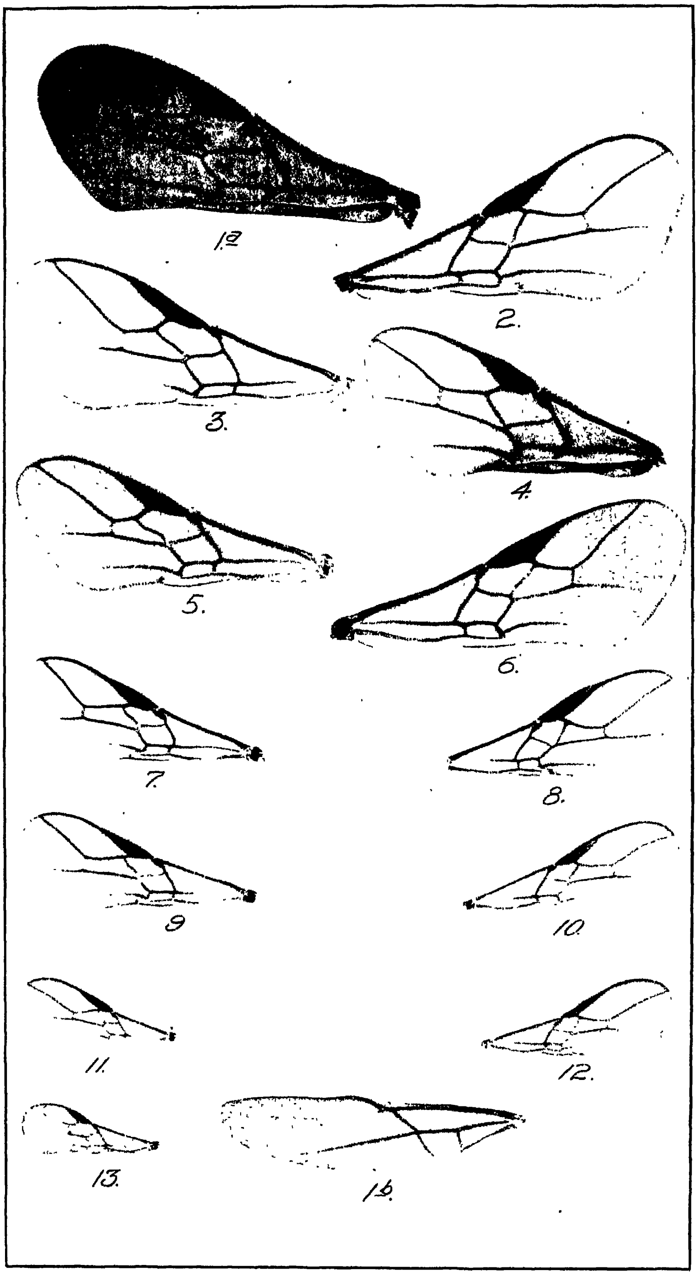
PLATE 35.

Fig. 1. *Opius sanguineus.* (*a*) Anterior wing. (*b*) Posterior wing.
2. *Opius crassiceps.* Anterior wing.
3. *Opius foveolatus.* Anterior wing.
4. *Opius anastrephae.* Anterior wing.
5. *Opius politus.* Anterior wing.
6. *Opius anthomyiae.* Anterior wing.
7. *Opius foersteri.* Anterior wing.
8. *Opius apicalis.* Anterior wing.
9. *Opius mandibularis.* Anterior wing.
10. *Opius oscinidis.* Anterior wing.
11. *Opius dimidiatus.* Anterior wing.
12. *Opius striativentris.* Anterior wing.
13. *Gnamptodon nepticulae.* Anterior wing.



DETAILS OF BRACONIDAE OF THE SUBFAMILY OPIINAE.

FOR EXPLANATION OF PLATE SEE PAGE 95.



WINGS OF THE BRACONIDAE OF THE SUBFAMILY OPIINAE.

FOR EXPLANATION OF PLATE SEE PAGE 95.

DESCRIPTIONS OF TWO NEW SPECIES OF ENTOMOSTRACA FROM COLORADO, WITH NOTES ON OTHER SPECIES.

By G. S. Dodds,

Of the Department of Zoology, University of Missouri, Columbia, Missouri.

The following notes and descriptions are based upon material collected by the author during four seasons spent at the Summer Mountain Laboratory of the University of Colorado, at Tolland, Colorado. The laboratory is at an elevation of about 8,900 feet, at the edge of an area with a large number of small glacial lakes, in which is found an abundant entomostracan fauna.

Subclass PHYLLOPODA.

Order ANOSTRACA.

Family STREPTOCEPHALIDAE.

STREPTOCEPHALUS COLORADENSIS, new species.

Male.—The frontal appendage is finger-shaped and reaches to about three-fourths of the length of the first joint of the second antennae. The first antennae are slender, slightly tapering, and reach about to the end of the first joint of the second antennae. The second antennae are of the usual three-jointed type of the genus. The first joint is about twice as long as wide, very slightly curved backwards, and has the front margin decidedly longer than the back. It is slightly narrower at the distal than at the proximal end. The appendage at the posterior distal margin is about as long as the joint itself, is slender and moderately tapering. The second joint is much more slender than the first and just a little shorter. It is bent abruptly at about the middle. The third joint is shorter than either of the others and bears two long appendages which cross each other scissors fashion, the proximal one being on the outside. These appendages are directed in a downward and posterior direction. The proximal one has a length about equal to the combined length of the first two joints of the antenna. Its proximal two-fifths is flattened and its forward margin is rolled inward, forming a very decided concavity. At the posterior distal margin of this portion is a short fingerlike process which is not hooked over the other appendage as in *S. sealii* Ryder. The rest of the appendage is a slender structure with an elbowlike bend at about its proximal third, beyond which it tapers uniformly and curves slightly forward. The distal appendage of the third joint is about two-thirds as long as the proximal. Just a little short of the middle it curves rather sharply forward through nearly 90°. The portion proximal to this bend bears on its anterior margin two fingerlike processes, the distal of which is about twice as long as the proximal. Beyond the bend, this appendage is slightly curved backward and tapers to a point. (Fig. 1.) The coiled vas deferens appears externally on the side of the 13th segment. The two penes are nearly in contact at their extremities and reach not quite to the middle of the 15th segment.

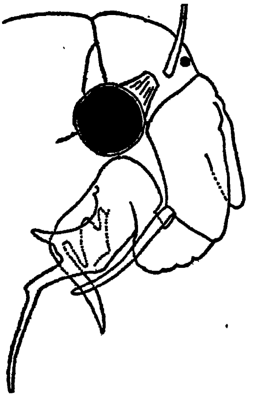


FIG. 1.—STREPTOCEPHALUS COLORADENSIS. HEAD OF MALE. × 8.

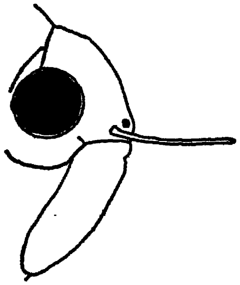


FIG. 2.—STREPTOCEPHALUS COLORADENSIS. HEAD OF FEMALE. × 8.

Average length 22 mm.

Female.—The first antennae are as in the male. The second antennae are of the usual broad and flattened type and are about as long as the first. The end is rounded, but bears a small spinelike outgrowth at the inner distal margin. (Fig. 2.) The ovisac is about half the diameter of the abdomen, arises from the 14th postcephalic segment, and reaches about to the middle of the 18th. The eggs are of moderate size and are arranged in four definite rows.

Average length 23 mm.

In both sexes there are 11 pairs of swimming feet.

This species is common in two ponds near Eldora, Colorado, in the Front Range of the Rocky Mountains at an elevation of 8,500 feet. I collected material here during the summers of 1913 and 1914. A collection recently sent me from Fort Collins, Colorado, near the western edge of the great plains, contains an abundance of this species.

Type-locality.—Sulphide Pool, near Eldora, Colorado.

Type.—Male, Cat. No. 47876, U.S.N.M.; paratype, female, Cat. No. 47876, U.S.N.M.

Subclass COPEPODA.

Order EUCOPEPODA.

Family CENTROPAGIDAE.

DIAPTOMUS ARAPAHOENSIS, new species.

This is a red species of moderate size. The cephalothorax is moderately slender, with its greatest width about the middle (posterior margin of second segment). The last segment is produced posteriorly on either side into a somewhat triangular lobe of considerable size, less pronounced in the male than in the female. Each lobe bears two small spines, one at the distal angle, and the other at about the middle of the inner dorsal margin. The first segment of the female abdomen is slightly less in length than the two following. Its greatest width is somewhat beyond the middle, back of which it becomes abruptly narrower. It bears two spines on either side, a moderate-sized one at the point of greatest width, and a smaller one about halfway between this point and the posterior end of the segment. The second segment is indistinctly separated from the first, is slightly shorter than the third, and its length is slightly less than its width. The furcal rami are a little shorter than the third segment, are ciliated on the inner margin and have a few cilia on the outer margin also. (Fig. 3.) The female antennae reach slightly beyond the end of the cephalothorax. The male antennae are relatively longer, reaching beyond the middle of the abdomen. The male right antenna is moderately enlarged. Its antepenultimate segment bears a slender, straight process, which reaches about to the middle of the ultimate segment. (Fig. 4.) The first basal segment of the female fifth foot bears the customary small spine. The lateral hair of the second basal segment is slender. The first segment of the exopodite is a little more than twice as long as broad. The claw of the second segment is slightly sinuous, its inner margin is finely denticulate, and its outer margin bears some small spines. There is a small spine at the outer distal margin of this segment.

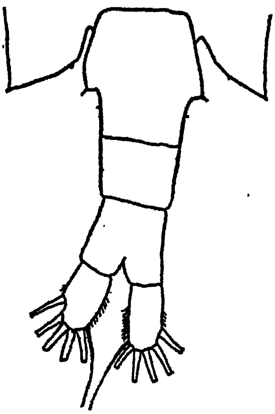


FIG. 3.—DIAPTOMUS ARAPAHOENSIS. ABDOMEN OF FEMALE. × 50.

The third segment is distinct and unusually well developed. It bears two spines, the inner of which is slightly setose and about twice as long as the outer one. The endopodite reaches about to the middle of the first segment of the exopodite and bears two or three small spines near its tip. (Fig. 5.) The spine of the first basal segment of the male fifth feet is of moderate size. The second basal segment of the right foot is about one-fourth longer than wide and bears, at about the middle of its inner surface, a small hyaline appendage. The lateral hair is slender and arises at about the beginning of the distal third of the segment. The first segment of the exopodite is short and its outer margin is much longer than the inner. At its outer distal angle it bears a hyaline appendage. The second segment is about twice as long as broad, having its greatest width a little beyond the middle. From this point arises the lateral spine, which is about as long as the segment, nearly straight, and uniformly tapering to a sharp point. It extends in a direction but little divergent from the axis of the segment. Its inner margin is very finely denticulate. This segment has a small crescent-shaped hyaline elevation about the middle of its posterior surface. The terminal hook is considerably longer than the rest of the exopodite and tapers to a very fine point. It is falciform, with slightly recurved tip, and is finely denticulate on its inner margin. The endopodite reaches to about the middle of the second segment of the exopodite, and is moderately pointed at the tip, near which are a few very small spines. The left fifth foot, exclusive of the long appendages, reaches a little beyond the end of the first segment of the right exopodite, and including the appendages, extends nearly to the end of its second segment. The second basal segment of this foot is about one-fourth longer than broad. There is a small hyaline appendage on its inner margin just a little short of the middle and the lateral hair arises at the end of the second third of the outer margin. The combined length of the two segments of the exopodite about equals the length of the second basal segment. The first segment of the exopodite is about half as wide at its distal as at the proximal end and its inner surface bears a setose pad. The second segment is somewhat shorter than the first and there is a prominent setose pad on its inner surface. The curved terminal processes almost equal the combined length of the two segments. The outer one is blunt

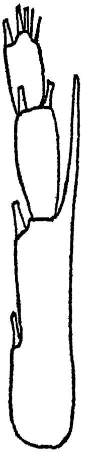


FIG. 4.—DIAPTOMUS ARAPAHOENSIS. LAST THREE SEGMENTS OF RIGHT ANTENNA OF MALE. ×188.

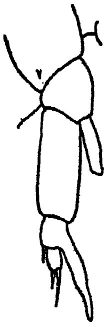


FIG. 5.—DIAPTOMUS ARAPAHOENSIS. FIFTH FOOT OF FEMALE. ×82.

at the tip and bears on its convex (inner) surface a row of small teeth. The inner one is more slender, tapers uniformly to a fine point, and is finely setose. The endopodite nearly equals the exopodite in length and bears near the tip a few very small spines. (Fig. 6.)

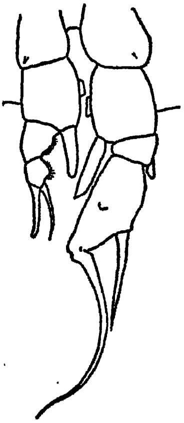


FIG. 6.—DIAPTOMUS ARAPAHOENSIS. FIFTH FEET OF MALE. × 82.

Length of female, 2.1 mm. Length of male, 1.7 mm. These are the measurements in the lakes where they attain the greatest size. In one lake they were respectively 1.6 and 1.35 mm.

I have found this species in four mountain lakes in Colorado at elevations of about 11,000 feet.

Three of these lakes, known locally as the Arapahoe Lakes, are located just east of the Continental Divide a short distance from the railroad station Corona, on Rollins Pass. The fourth locality is a lake about 12 miles farther north. *Diaptomus shoshone* Forbes is also found in each of these lakes.

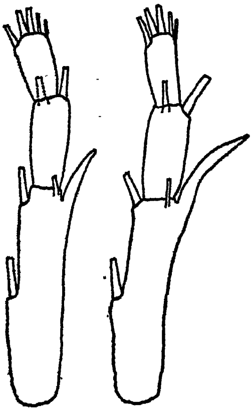


FIG 7.—DIAPTOMUS LINTONI. LAST THREE SEGMENTS OF MALE RIGHT ANTENNA, SHOWING THE TWO EXTREMES OF THE APPENDAGE OF THE ANTEPENULTIMATE SEGMENT. × 188.

Type-locality.—South Arapahoe Lake, Colorado.

Type.—Male, Cat. No. 47878, U.S.N.M. Paratype, female, Cat. No. 47878, U.S.N.M.

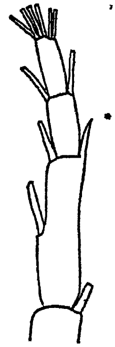


FIG. 8.—DIAPTOMUS LINTONI. TERMINAL SEGMENTS OF MALE RIGHT ANTENNA. COPIED FROM FIGURE OF FORBES.

DIAPTOMUS LINTONI Forbes.

This species was collected and described by Forbes[1] from Yellowstone Park where he found it "common in lakes and pools.'' Apparently it has not since been collected until it appeared in my collections from Colorado. During the summers of 1908, '12, '13, and '14, I have found it as an important part of the fauna of two lakes, known as Teller Lakes, near the town of Tolland, Colorado, at an elevation of 9,575 feet. Though collections were at the same time made from a considerable number of other lakes in the same region, the species was found only in these two lakes. Forbes states that in Yellowstone Park it occurs commonly with *D. shoshone.* The two lakes in which I have found the species are just about at the lower altitudinal range of *D. shoshone* in this region. In one of them it forms a minor part of the fauna and in the other I have never found it.

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[1] S. A. Forbes, A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyoming, and of the Flathead region of Montana. Bull. U. S. Fish Com., 1891, pp. 207-258.

These specimens agree well with the description of Forbes except in one particular which seems worthy of comment. He figures the antepenultimate segment of the male right antenna with a *straight* process, though in his description he does not state whether it is straight or curved. Marsh,[1] in his key, interprets it as a straight process. In my material this process is always decidedly curved, though it varies considerably in length. The conditions represented in figure 7 show the two extremes between which most specimens lie. Figure 8 is a copy of Forbes's drawing from the Yellowstone material.

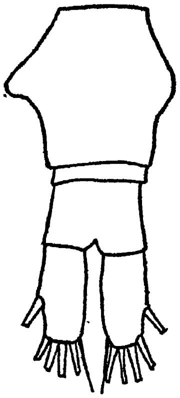

FIG. 9.—DIAPTOMUS SHOSHONE. FEMALE ABDOMEN. × 50.

DIAPTOMUS SHOSHONE Forbes.

This is the most common Copepod in the mountains west of Denver, where I have collected it at elevations from 9,575 to 12,188 feet, but mostly in lakes above 11,000 feet. It ranges along the highest parts of the Rocky Mountain range, having been collected by Forbes in the Yellowstone region and by Ward[2] at Pikes Peak. Though Forbes does not figure the female abdomen, he describes it as being asymmetrical. Marsh[2] states that in the Pikes Peak material he does not find this to be the case as does also Schacht[3] who studied Forbes's collections. Marsh's figures, however, drawn, I suppose, from the Pikes Peak material, show the first segment of the female abdomen as distinctly asymmetrical. In my collections this asymmetrical condition prevails, as illustrated in figure 9. Marsh mentions the fact that he finds the endopodite of the female fifth foot and of the left male fifth foot to be indistinctly two-segmented. This is also the case with my specimens. It may also be worthy of note that in some lakes the appendage of the antepenultimate segment of the male right antenna is much longer than is the general rule, reaching well beyond the end of the ultimate segment.

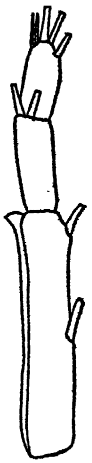

FIG. 10.—DIAPTOMUS LEPTOPUS, VAR. PISCINAE. TERMINAL SEGMENTS OF MALE RIGHT ANTENNA. × 188.

DIAPTOMUS LEPTOPUS, var. PISCINAE Forbes.

This is the most common representative of the genus in the lakes of the Tolland region below 11,000 feet. In all my specimens the hyaline lamella of the antepenultimate segment of the male right antenna is expanded at the distal end into a very decided angle, as seen in figure 10. So far as I know, this has not been mentioned or figured for material from other localities.

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[1] C. Dwight Marsh, A revision of the genus Diaptomus. Trans. Wis. Acad., vol. 15, pt. 2, 1907, pp. 381–486.

[2] C. Dwight Marsh, Report on the Copepoda, In A biological reconnaissance of some elevated lakes in the Sierras and the Rockies, by Henry B. Ward. Studies from Zool. Lab. Univ. of Nebr., vol. 3, 1904, pp. 146–149.

[3] F. W. Schacht, The North American species of *Diaptomus*. Bull. Ill. State Lab. Nat. Hist., vol. 5, art. 3, 1897.

FLIES OF THE GENUS AGROMYZA, RELATED TO AGROMYZA VIRENS.

By J. R. MALLOCH,
Of Urbana, Illinois.

The species dealt with in this paper belong to a group which is distinguished from all others in *Agromyza* by the black halteres.

When at work upon the species of *Agromyza* in the collection of the United States National Museum in 1913, I had considerable difficulty in finding characters by means of which the numerous closely allied species could be separated and had to use minute ones which had not previously been given in descriptions of species of the genus. Because of this departure from previous usage, and also because I realized that I was dealing with a large and complex group and not with merely a few widely distributed species, I refrained from associating but one of them with European forms. Just prior to the appearance of my paper[1] one by Prof. A. L. Melander appeared,[2] in which are given the names of several species of this group which belong to the European forms, but which are also said to occur in America. I have already given my reasons for refusing to adopt the course taken by Professor Melander[3] and believe that, independent of the fact that identifications of European species described by the old authors in this group are only guesses up to the present, from the existence of such a large number of very closely allied species I am justified in my refusal to recognize American species as synonymous with those of Europe until we know to what European forms certain names really belong. I have accepted the European species *schineri* as occurring in eastern Canada and Massachusetts because the description agrees with that given by Giraud, but more especially because the larvæ of the European species and that of the specimens from Massachusetts both make galls on twigs of poplar. It is not my purpose to deal with questions arising from the publication of Professor Melander's synopsis of this genus, but I am not inclined to consider it as even possible for *simplex* Loew and *tibiae* Couden to be varieties of *maura* Meigen. The larvæ of the latter makes galls upon twigs of linden, while *simplex*[1] mines in stems of asparagus. The foregoing statements are not made with any intention of criticising Professor Melander's work, but merely to justify my own attitude with regard to the use of European species names until we are in possession of reliable information as to what species these names really apply to. As a further evidence that extreme care is required when identifying specimens belonging to this group, I present the facts contained in this paper. I was obliged, when working upon the paper previously referred to, to request Mr. C. W. Johnson to examine the type of *Agromyza virens* Loew in Museum of Comparative Zoology in Cambridge, Massachusetts, and report to me upon certain characters. Mr. Johnson kindly did so, and upon his information I based my identification of Loew's species. I had, however, a strong suspicion that I had more than one species before me, though the material was not sufficient to permit me at that time forming a definite opinion. Since coming to Illinois I have upon every occasion collected specimens of this group, until I have before me at the present time a series of three species which enable me to come to a conclusion with regard to their identity. A fourth species sent me by Prof. F. M. Webster is also included, which I have not succeeded in obtaining here. I give a synopsis of the four species below. This synopsis may be inserted in that which is given in my paper already referred to at the points in table where the name *virens* occurs.

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[1] Ann. Entom. Soc. Amer., vol. 6, No. 3, Sept., 1913.
[2] Journ. N. Y. Entom. Soc., vol. 21, No. 3, Sept., 1913.
[3] Entom. News, vol. 25, 1914, p. 308.

The type-specimen of *gibsoni* and paratypes, with exception of 4 specimens in the collection of the Illinois State Laboratory of Natural History, have been returned to the Bureau of Entomology. The type-specimens of the other 2 new species are in the former collection, while paratypes will be deposited with the Bureau of Entomology.

Synopsis of Species.

a^1 Last section of fifth vein at least as long as penultimate section. . *riparia*, new species.
Last section of fifth vein distinctly shorter than penultimate section. . . . . a^2.
a^2 Five pairs of orbital bristles present; frons not noticeably buccate. *subvirens*, new species.
Four pairs of orbital bristles present. . . . . a^3.
a^3 Frons buccate; eyes of male distinctly hairy, of female pubescent above; last section of fourth vein 3–3½ times as long as penultimate. *virens*.
Frons not buccate; eyes of male bare or slightly pubescent. . . . . a^4.
a^4 Outer cross vein slightly bent; last section of fourth vein 5 to 6 times as long as penultimate. . . . . *gibsoni*.
Outer cross vein straight; last section of fourth vein 3–4 times as long as penultimate. *eupatoriae*.

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[1] J. E. Collin in his paper on British Muscidae Acalyptratae (Ent. Mon. Mag., vol. 22, 1911, p. 254) treats *simplex* and *maura* as distinct species.

Specific characters.—As indicated, all four species are similar in color. All are glossy black, the abdomen being more or less distinctly tinged with bronze, green, or, especially at apex, with a violaceous lustre. The wings are hyaline, but in *riparia*, and especially in the male of that species, they are often slightly suffused with brown. The squamae are white with pale fringes. Halteres black.

AGROMYZA RIPARIA, new species.

Female.—Head in profile as in fig. 1; frons barely over one-third the head width, and 1½ times as long as broad; triangle glossy, long and slender, reaching three-fourths the distance to lunule; ocellar bristles parallel, directed forward; orbits of almost uniform width on their entire length, each equal to one-third the width of center stripe; 5 pairs of orbitals present, situated close to inner margin of orbits, becoming sucessively weaker anteriorly, the anterior 3 pairs incurved, orbital hairs numerous though weak; arista slender, almost bare, its length about 1½ times that of width of frons anteriorly; eyes without distinct pile. In front of the anterior pair of dorsocentrals there are generally at least 1 pair, rarely 2, of setulae which are distinctly stronger than the weak discal setulae, but which can hardly be considered as dorso-centrals because of their close approximation to the anterior pair and their inconstancy, being sometimes absent on one side and present on the other in individual specimens; the discal setulae are numerous, 10–12 irregular rows between the dorso-centrals. Abdomen ovate; surface with numerous short hairs, those at apex and on lateral margins at base longer. Mid tibia with the pair of bristles present though weak. Wings as in fig. 2.

Length, 1.75–2 mm.

Type-locality.—Urbana, Illinois, July 4, 1914. A series of 15 specimens taken by the writer and Mr. C. A. Hart on vegetation in the dry portions of the old channel bed of Salt Fork. Six paratypes, Algonquin, Illinois, June, July, September, and October, W. A. Nason; and one, St. Joseph, Illinois, May 10, 1914, same collectors as type series.

The male agrees with the female except in having the abdomen more slender, the hypopygium small and knoblike, and the wings more distinctly infuscated.

Food plant.—Unknown.

Paratype.—Cat. No. 19390, U.S.N.M.

AGROMYZA SUBVIRENS, new species.

Female.—Differs from *riparia* in head characters as follows: Frons subquadrate, distinctly over one-third the head width; triangle short and broad, reaching three-fourths the length of frons; orbits over one-third as wide as central stripe; 5 pairs of bristles situated near to inner margin of orbits, their length not so distinctly reduced anteriorly as in previous species; ocellar bristles short, parallel; orbital hairs numerous and short; pile on eyes barely distinguishable; arista bare, swollen at base, entire length about 1½ times that of anterior width of frons; profile as in fig. 3. Mesonotum with two pairs of dorso-centrals; discal setulae very numerous, short, and irregular. Abdomen ovate, apex and lateral margins with rather long hairs, surface hairs short and not very numerous. Mid tibial bristles distinct. Wings as fig. 4.

Length, 2.5-3 mm.

Type-locality.—St. Joseph, Illinois, May 17, 1914, taken by the writer and Mr. C. A. Hart. Paratype, Algonquin, Illinois, May 17, 1894, W. A. Nason.

The male agrees with the female except that it is more slender and the wings are a trifle narrower.

Food plant.—Unknown.

Paratype.—Cat. No. 19391, U.S.N.M.

AGROMYZA VIRENS Loew.

Female.—Differs from *subvirens* only in the arrangement of the orbital bristles, which is shown in fig. 5, and in having the frons distinctly buccate.

Male.—Similar to female, but the pile is very conspicuous on a small area on upper surface of eyes near to margin. Venation as fig. 6.

AGROMYZA GIBSONI, new species.

Female.—Profile as fig. 7; frontal triangle rather broad, reaching well beyond half way to lunule; anterior pair of orbitals cruciate, second pair incurved but inclining slightly backward, upper 2 pairs very close together, the lower pair slightly incurved, the upper slightly inclined outwardly; orbital hairs numerous; eyes without distinguishable pilosity. Mesonotum as in *virens*. Venation as fig. 8.

Male.—Similar to female; hypopygium of normal size.

Length 2 mm.

Pupa.—Pale shining yellow. Segments, except the last 3 with their anterior halves covered with closely placed microscopic setulae; posterior spiracles short, disk-like, figs. 9 and 10.

Length, 3 mm.

Type-specimen.—Tempe, Arizona, reared from alfalfa, by E. H. Gibson, for whom the species is named. Webster's number 12239.

Type.—Cat. No. 19392, U.N.S.M.

I had difficulty in deciding whether this species was distinct from *phaseoli* Coquillett, described from specimens mining in stems of French beans in Australia, but an examination of one of the paratypes forwarded from the United States National Museum proves that it is distinct, though closely related. *Phaseoli* has the head almost similar to that of *riparia*, the orbital hairs very weak, the vibrissæ comparatively stronger, the cheek narrower, the eye more elongate, and the venation different, the inner cross vein being but slightly beyond the middle of the discal cell and the last section of fourth vein 4 times as long as penultimate section. Length: 1 mm.

Pupa: Colored as that of *gibsoni*, but more glossy. Setulæ indistinguishable, posterior spiracles as fig. 11.

AGROMYZA EUPATORIAE, new species.

Closely resembles *gibsoni*, but separable by the following characters: The 4 pairs of orbitals are comparatively stronger and more equal in length; the eyes of the male are slightly pubescent above, the cheeks are linear in the male, slightly higher in the female, the last sections of the third and fourth veins are more regularly and decidedly divergent; the penultimate section of fourth vein in the male is slightly over one-fourth as long as ultimate; in female it is nearly one-fourth as long as ultimate and the outer cross vein is straight (in *gibsoni* it is very slightly but distinctly bent outward at middle). In other respects similar to *gibsoni*.

Type-specimen.—Rio Piedras, Porto Rico, July 16, 1914. Reared from *Eupatorium odoratum*, by Thos. H. Jones, P. R. S. G. A., Acc. No. 775–1914.

Type.—Cat. No. 19393, U.S.N.M.

The following species does not belong to the group dealt with in the previous paper, but for convenience is inserted with them, as are also the nomenclaturial notes at end of this paper.

AGROMYZA CONICEPS, new species.

Female.—Glossy black; halteres black; squamæ brownish; fringes dark brown; wings clear, veins black.

Head in profile as figure; frons one-third the head width, slightly narrowed anteriorly, its length about 1½ times its width; orbits well defined, very narrow, at the broadest part not more than one-fifth as wide as center stripe; orbital bristles 4 in number, the lower 2 pairs slightly incurved; orbital hairs numerous; frontal triangle glossy and well defined, not extending to middle of frons; mouth margin produced as in figure. Mesonotum with 2 pairs of dorso-central bristles; discal setulæ numerous, about 12 irregular rows between the dorso-centrals, continued to the transverse level of posterior dorso-centrals; scutellar bristles subequal, the apical pair cruciate. Abdomen ovate; ovipositor normal. Legs normal in shape; mid tibiae without distinguishable bristles posteriorly. Costa to fourth vein; inner cross vein below

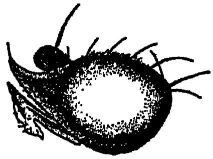

FIG. 12.—AGROMYZA CONICEPS. HEAD OF MALE IN PROFILE.

end of first vein and at three-sevenths from apex of discal cell; last section of fourth vein over 4 times as long as penultimate section; last section of fifth vein very slightly shorter than penultimate section; last sections of veins 3 and 4 distinctly divergent.

Length, 2 mm.

Type-specimen.—Salt Lake, Utah, August 4, 1914. Reared from larvæ mining in *Sonchus asper*, by P. H. Timberlake. Timberlake's No. 915*a*.

Type.—Cat. No. 19394, U.S.N.M.

This species belongs to the group which has the anterior angle of cheeks produced in both sexes and the vibrissae in the form of a fasciculus in the male. *Coniceps* is closely allied to *affinis* Malloch, from which it may be separated by the less strongly bristled frons, the narrow orbits, conspicuously produced mouth margin, and different venation.

Notes on names of *Agromyza* species can be found in a paper dealing with Formosan species of Agromyzidae,[1] and in one on North American species.

I inadvertently erred in leaving the name *atrata* in my table of species in *Agromyza;* this should read *nigrita* as in the text. Also I used the species name *niveipennis*, which is preempted by *niveipennis* Zetterstedt; I propose to change the name of my species to *vitrinervis,* new name. I also overlooked Strobl and Czerny's name *infumata* in this genus and made a homonym in describing a North American species.[2] This species may be known by the new name *subinfumata*.

EXPLANATION OF PLATE 36.

Fig. 1, *Agromyza riparia*, head in profile.
2, *Agromyza riparia*, wing.
3, *Agromyza subvirens*, head in profile.
4, *Agromyza subvirens*, wing.
5, *Agromyza virens*, head in profile.
6, *Agromyza virens*, wing.
7, *Agromyza gibsoni*, head in profile.
8, *Agromyza gibsoni*, wing.
9, *Agromyza gibsoni*, apex of pupa.
10, *Agromyza gibsoni*, apex of posterior and spiracle of pupa.
11, *Agromyza phaseoli*, posterior and spiracle of pupa.

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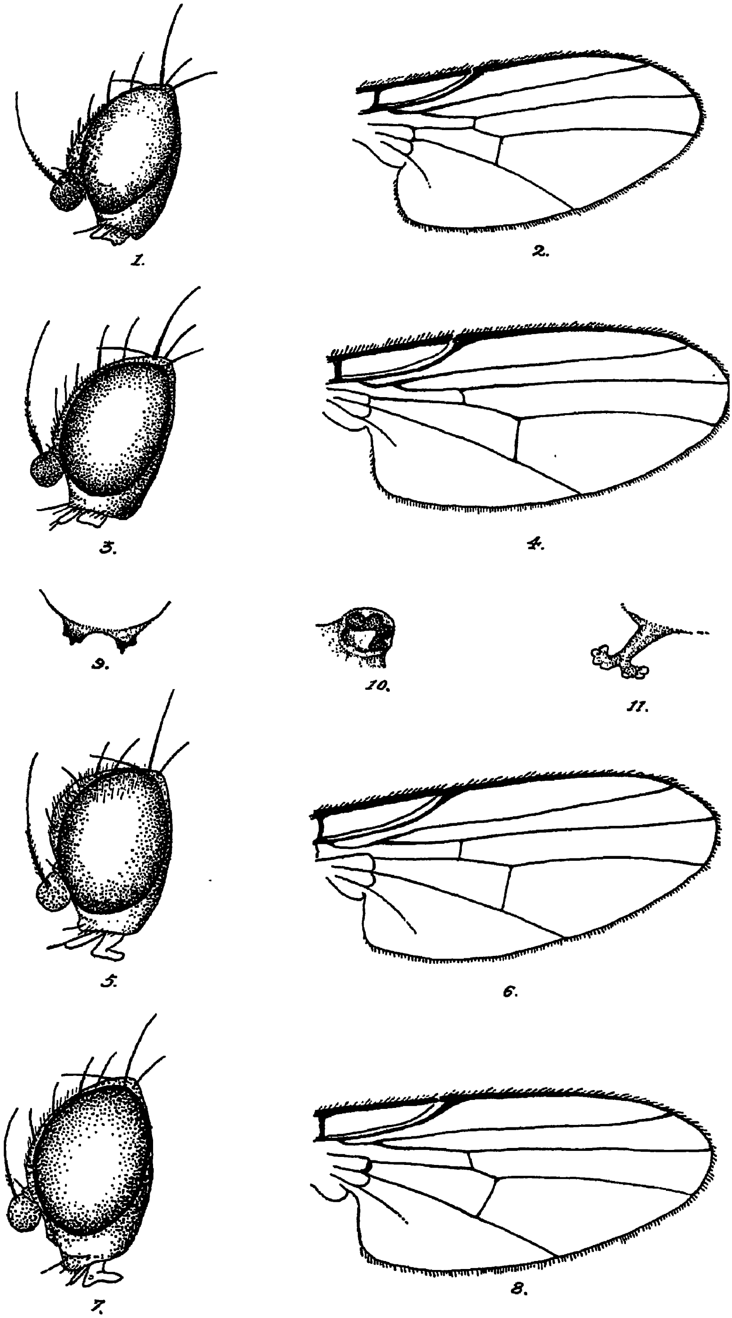
[1] Ann. Nat. Mus. Hung., vol. 12, 1914, pp. 306-336.

[2] Can. Ent., 1915, p. 15.



DETAILS OF AGROMYZA SPECIES, PUPÆ, AND IMAGINES.

FOR EXPLANATION OF PLATE SEE PAGE 108.

NOTES ON THE COMPOSITION AND STRUCTURE OF THE INDARCH, RUSSIA, METEORIC STONE.

By George P. Merrill,

Head Curator, Department of Geology, United States National Museum.

This interesting stone fell, according to V. Siemaschko, on April 7, 1891, though Meunier[1] gave the date as April 9. According to Wülfing's catalogue the stone has since been described by Tarassow, but seems never to have been subjected to a thorough microscopic or chemical investigation. I have, therefore, included it in the studies on the minor constituents on which I have been engaged.[2]

It is stated by Meunier that in falling the stone buried itself in the soil to a depth of 18 cm. and scorched the vegetation for a radius of 10 meters, being still hot when exhumed 10 hours later. The dark color he regarded as due to the heat to which it had been subjected, and he claimed to have produced similar results in the laboratory on stones of his Montrejeit group.

Macroscopically the stone is of a dark greenish gray color, firm and compact, admitting of a polish, and on the polished surface thickly studded with small, dark, almost black chondrules and nodular masses of metal and troilite, the largest of which are rarely over 1 mm. in diameter. Under a pocket lens the chondrules are mostly of a green color, though some are nearly black. They break with the matrix in which they are embedded. In thin sections and under the microscope the structure is quite obscure owing to the prevalence of graphite, which everywhere impregnates it. It presents a dense black irresolvable ground throughout which are scattered the iron and iron sulphide, together with abundant sharp splinters of pyroxene and numerous more or less fragmentary chondrules of the same mineral in both porphyritic and radiating forms (see pl. 37). All of the well crystallized forms, both in isolated particles and in the chondrules, belong to the polysynthetically twinned clino-enstatite type. No olivine, feldspar, or other silicate mineral was determined, though carefully sought, as their presence was suggested by the analysis. The presence of carbonic acid, as shown by the analysis, suggested the mineral breunnerite, but this could not be determined absolutely owing to the obscuring effect of the graphite already mentioned, although the solution obtained by boiling for a few minutes in dilute (1–4) hydrochloric acid reacted distinctly for magnesia. The calcium sulphide, oldhamite, was, however, detected first by chemical means and afterward by the microscope. The mineral occurs in the slide in the form of irregular areas, sometimes interstitial and sometimes inclosed in the enstatite. It is of a yellow brown color, sometimes greenish, completely isotropic, and with well developed cubic cleavage. Attempts at isolation of the mineral failed. Microchemical tests were also rendered futile by the abundant hydrogen disulphide given off when the slide was treated with even the most dilute acid. On boiling 9.35 grams of the finely pulverized stone for one hour in distilled water the solution, smelling distinctly of H_2S, yielded 0.464 per cent CaO, the equivalent of 0.596 per cent CaS.

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[1] Comptes Rendus, vol. 125, 1897, p. 894.

[2] See preliminary paper, Amer. Journ. Sci., vol. 35, 1913, pp. 509–525.

Analyses of the stone by Dr. J. E. Whitfield yielded the results given below:

Metallic portion separated by mercuric chloride solution.

	Per cent.
Iron (Fe)	90.44
Nickel (Ni)	8.26
Cobalt (Co)	0.18
Phosphorus (P)	0.08
Manganese (Mn)	1.04
	100.00

Silicate portion, free as possible from the metal, sulphides, and graphite, yielded:

	Per cent.
Silica (SiO_2)	47.970
Alumina (Al_2O_3)	2.647
Ferrous oxide (FeO)	19.283
Phosphoric acid (P_2O_5	0.699
Manganous oxide (MnO)	0.175
Nickel oxide (NiO)	0.739
Cobalt oxide (CoO)	0.067
Lime (CaO)	1.559
Magnesia (MgO)	22.736
Carbonic acid (CO_2)	0.363
Soda (Na_2O)	Trace.
Potash (K_2O)	None.
Water (H_2O)	3.762
	100.00

Independent determinations showed 13.296 per cent of FeS and 0.31 per cent of graphite.

A recalculation of these analyses gives the following, showing the composition of the stone as a whole:

	Per cent.
Silica (SiO_2)	35.699
Alumina (Al_2O_3)	1.969
Ferrous oxide (FeO)	25.790
Manganous oxide (MnO)	0.130
Nickel oxide (NiO)	0.549
Cobalt oxide (CoO)	0.049
Lime (CaO)	1.160
Magnesia (MgO)	16.920
Carbonic acid (CO_2)	0.271
Phosphoric acid (P_2O_5)	0.520
Water (H_2O)	2.799
Iron (metallic) (Fe)	10.400
Nickel (Ni)	0.949
Cobalt (Co)	0.020
Phosphorus (P)	0.092
Manganese (Mn)	0.119
Carbon (graphite) (C)	0.310
Sulphur	5.100
	102.846
Correction for O	2.54
	100.306

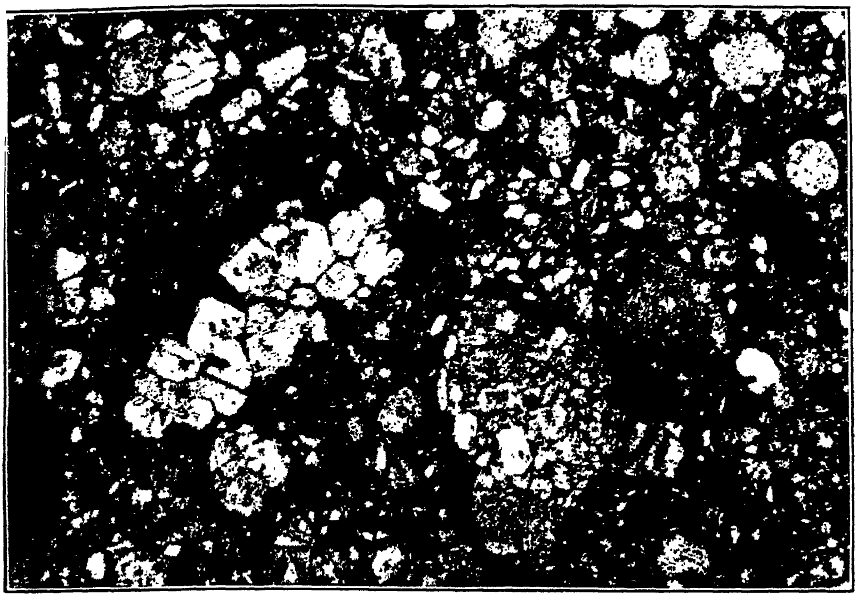
No barium, strontium, or zirconium could be detected.

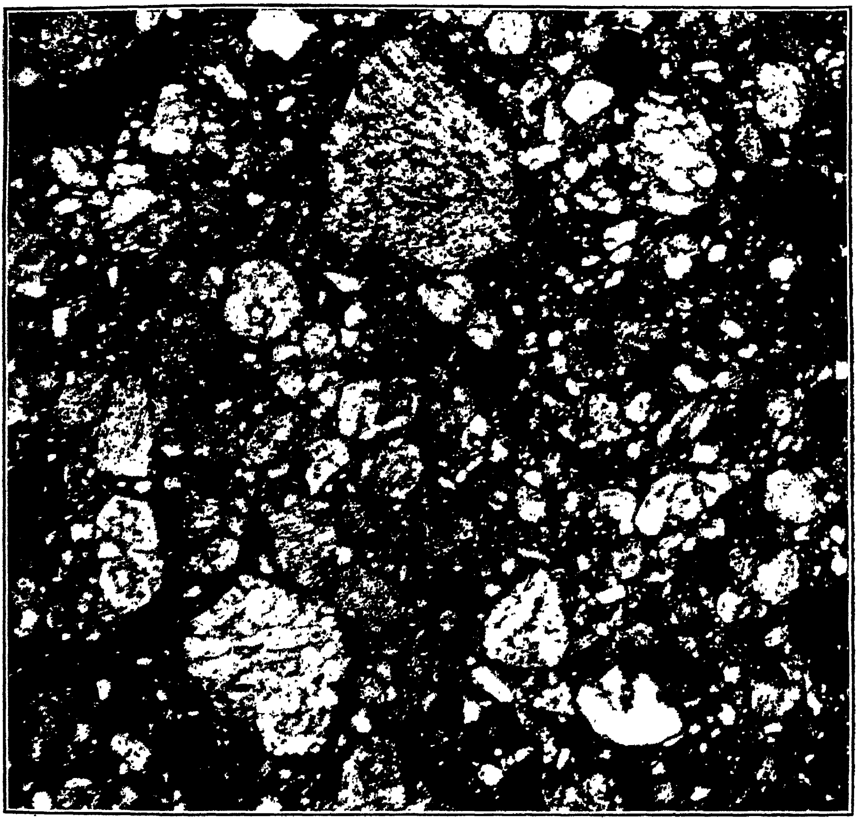
The presence of water, though as a rule not expected, has before been noted in carbonaceous meteorites and in the present case at least is due to the oxidation and hydration of the sulphides and perhaps small amount of lawrencite. The mineral composition so far as determined by analysis and microscopic examination is:

	Per cent.
Silicate (enstatite)	74.42
Metal	11.50
Troilite	13.296
Oldhamite	0.596
Graphite	0.31
	100.122
Specific gravity	3.42

The stone is classed by Wülfing as a carbonaceous chondrite (Kc). Meunier places it in his Stawropolite Group.

So far as the author at this moment recalls, oldhamite has up to the present time been either found, or suspected to occur, in the meteoric stones of Allegan, Bishopville, Busti, Hvittis, Indarch, and St. Mark's. In the first two its presence has been shown only by chemical tests; in the other four its presence has as well been revealed by the microscope. How prevalent it may be in other stones remains to be seen and often much care and study must be devoted to its search, as it is quite inconspicuous and until once seen difficult of recognition. It is of interest to note that thus far its presence does not seem to be characteristic of any particular class of stones, the Allegan being a chondritic tuff (Cco), Busti standing in a class almost by itself (Bu), Bishopville an almost purely pyroxenic stone (Chl), Hvittis a chrystalline "kugelchen" chrondite (Cck), Indarch a carbonaceous chrondite (Kc), and St. Mark's a chrystalline chondrite (Ck).





THE INDARCH, RUSSIA, METEORIC STONE.

THE DIPTEROUS GENUS SYMPHOROMYIA IN NORTH AMERICA.

By John Merton Aldrich,

Assistant, Cereal and Forage Insect Investigations, Bureau of Entomology.

The genus *Symphoromyia* was established by Frauenfeld in 1867.[1] Only one species is mentioned, *Atherix melaena* Meigen, which thus becomes the undoubted type of the genus. Happily, there is no nomenclatural dispute whatever about the correct application of the name, and it has never been used in any other sense than the original one. The known species are confined to Europe and North America.

The first North American species were mentioned by Osten Sacken in his Western Diptera, 1877, in a paragraph which is well worth quoting for its historic interest:

> *Symphoromyia*, sp.—Half a dozen species, which I took in Marin and Sonoma Counties in April and May, and about Webber Lake in July, all have the anal cell open and therefore belong to the genus *Symphoromyia* Frauenfeld (*Ptiolina* Schiner, not Zetterstedt). California seems to be much richer in this group than Europe or the Atlantic States of North America; but as these species resemble each other very closely, and as both sexes often differ in coloring, I deem it more prudent not to attempt to describe them.
>
> The female of one of these species which I observed near Webber Lake stings quite painfully and draws blood like a *Tabanus*. I am not aware of the fact ever having been noticed before concerning any species of Leptidae (p. 244).

The next occurrence of the genus in North American literature was when Williston described two species, *pachyceras* and *plagens*.[2] This was closely followed by an article by Bigot,[3] in which he described six species from North America, *latipalpis*, *picticornis*, *trivittata*, *fulvipes*, *atripes*, and *comata*. In an appendix to the same article, dated April 4, 1887, Bigot states that he has received Williston's paper and finds *picticornis* and *trivittata* to be synonyms of *plagens* and *pachyceras*, respectively.

The only general treatment which the genus has received in this country was by Coquillett,[4] in which 10 species are recognized.

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[1] Verh. zool.-bot. Ges. Wien, vol. 17, p. 497.

[2] Trans. Amer. Ent. Soc., vol. 13, 1886, p. 287.

[3] Bull. Soc. Zool. France, vol. 12, 1887, pp. 12-15.

[4] Journ. N. Y. Ent. Soc., vol. 2, 1894, pp. 53-56.

Bigot's species are reduced to synonymy, except *latipalpis*, and seven new species are described, five of them in only one sex. In the 20 years from this paper to the present Johnson has described two species, Adams one, and Coquillett one more.

In the following pages 22 species are recognized, of which 11 are known in both sexes, the male only in 5, and the female only in 6. Two or three of them are not firmly established. These figures show how much still remains to be done in collecting and studying the group.

Generic characters.—The genus includes Leptid flies with five posterior cells, the anal cell open; third antennal joint simple, rather deep vertically, attached above its middle, usually kidney-shaped (sometimes concave in profile below the arista, then not quite kidney-shaped); arista subapical; tibial spurs none in front, two in the middle, one behind, but often quite weak in males.

Specific characters.—There are several characters which may be used singly to divide the genus into two groups of several species each. Five species have the third antennal joint concave in profile below the arista, a character applying equally to both sexes and very distinct; sides of face pilose is found in nine species, but is slight in a few cases, especially in the female; infuscation of the halteres seems to be very useful, but there are cases in which it occurs in the male and not in the female. Color characters occur in antennae, palpi, legs, and abdomen, but except the last are prone to be variable and can be used only with great caution. Width of the front is a good character in females, several species having it much wider than one eye (always measured just above the antennae, viewed from in front). Several males of the group with concave third joint have a thornlike bunch of spines on the middle coxa, a very striking thing. Many males have on the front side of the hind coxae near the tip a distinct condyle, smooth, polished, rounded or conical, which fits into a corresponding socket in the hind side of the middle coxa. I have made but little use of this, because it is normally almost invisible and I could not compare its form satisfactorily in different species. I have not studied the male genitalia, although I do not doubt that in the course of time they will be found useful in critical cases. In my opinion it is not safe to depend merely on their characters as they occur in ordinary specimens, as they are not always folded in the same manner in the same species. It will probably be necessary to detach the organs and make permanent mounts of them.

Habits.—The bloodsucking habit of the female in one species is alluded to above in the quotation from Osten Sacken. Knab[1] mentions Osten Sacken's item already quoted, and adds an interesting list of cases where bloodsucking has been attributed to Leptidae of other genera; later in the same volume he mentions conversing with Prof. R. A. Cooley on the habits of a Montana species, and gives the following statement from him:

---

[1] Proc. Washington Ent. Soc., vol. 14, 1912, pp. 108, 116; and vol. 17, 1915, p. 38.

> We have repeatedly taken a species of *Symphoromyia* in the act of taking blood. They have always attacked me on the hand, and they inflict a painful wound. The first time I was bitten by one I slapped with the same caution that I would a mosquito, lest it should escape, but I soon learned that this was unnecessary, for one can pick them up with the fingers as he would an inert object. In fact, you may poke them around with the finger without causing them to fly. They come and alight almost silently and generally come singly. Our note on this species is as follows: "Note 143.—Troublesome bloodsucking fly. Causing swelling; very painful. Fly is silent when alighting."
>
> It is my impression that this is distinctly a mountain form; that is, we do not find it in our large open valleys, but only in mountainous places.

Mr. Cooley's specimens bearing the number 143 are *S. hirta* Johnson.

Prof. T. D. A. Cockerell furnishes the following hitherto unpublished instance of the bloodsucking habit:

> On July 6, 1914, at the Webber ranch, between Ward and Allens Park, Colorado, a *Symphoromyia* settled on my right hand close to the base of the little finger, and sucked blood. Unfortunately, I crushed the fly before noticing what it was, but I preserved the crushed specimen, smeared with blood. The wound was not painful; it appeared as a bright red spot, and soon healed. The next day, on the Longs Peak Trail above Longs Peak Inn, at about 10,000 feet, *Symphoromyia* attacked a lady member of our party. We captured two specimens, before they had drawn any blood, and preserved them in good condition. They belong to two different species, one of which is identical with the one from Webber ranch.

The three specimens accompanied the note; two are *S. hirta*, including the one which actually sucked blood; the other is *S. atripes*.

I found *S. atripes* Bigot very troublesome to horses on the stage road from Ashford, Washington, to Longmires Springs, in the Mount Rainier National Park. This was on August 2, 1905. There were about 100 flies at once hovering about the four-horse stage team, many biting the horses and a few the passengers. They were most abundant about the horses' heads, and I noticed the blood trickle down from punctures that the fly had left, indicating that the razor-edged mandibles cut a considerable hole in the skin. I have never seen Tabanidae attack horses so severely. See notes under *pachyceras* and *kincaidi*.

On several occasions I have had female Symphoromyias alight on my hands and clothing as if attracted, but depart without biting. However, on May 31, 1913, near Moscow, Idaho, I was bitten a couple of times by *S. inquisitor*, new species, which was plentiful that day. I captured some thirty specimens alighting upon me, or circling about my head exactly as a *Chrysops* does.

Female specimens will generally be taken by collectors when attracted in the manner just described, and occasionally on windows; rarely in any other way. Males, on the contrary, are never attracted to animals, and are only to be found on foliage in the sun, or rarely on windows. It will require much careful study to find and collocate the sexes still unknown of the species now known from only one sex, not to mention the probability of other species being in existence.

Specific names used by Williston and Coquillett (*plagens, limata, cruenta*) seem to imply a bloodsucking habit, but no observations have been published on these species, and Osten Sacken's note may have suggested the names.

Osten Sacken collected several females of *S. atripes* at Webber Lake and a single one each of *inurbana* and *cinerea;* it is therefore a fair presumption that *atripes* was the one which bit him.

The larval habits are unknown. In the nearest related genus, *Atherix,* the larvae live in water in mountain streams.[1] Other Leptidae have various larval habits; Professor Comstock showed me larvae of a species from the California Sierras which are ant-lions, like *Vermileo* of Europe; he did not succeed in rearing the adult, which remains unknown.

Distribution.—Of the 22 known North American species, only three occur east of the Rocky Mountain region, these three also occurring in the West along with the 19 others. California has 15 species; Washington and Montana, 5 each; Colorado, 4; British Columbia, Idaho, and Oregon, 3; other States and Provinces with smaller number. One peculiar thing is that, from Colorado eastward, no localities are represented in collections (with the exception of one specimen from Ohio and one from Alabama) until eastern Pennsylvania is reached. The species most widely distributed is what I have called *hirta,* which may, however, prove to be a complex; it is represented from Alabama to Alberta, and from New Hampshire to New Mexico. *Atripes,* the bad biter, occurs from Alaska to Colorado and California. Even these, however, seem to occur only here and there in the wide range mentioned. Most of the species are without doubt extremely local in occurrence within their range.

Acknowledgments.—Mr. J. E. Collin, Newmarket, England, lent me the types of Bigot's six species. Mr. Charles W. Johnson, of the Boston Society of Natural History, lent type material in *hirta, cinerea,* and *flavipalpis.* Director Samuel Henshaw, of the Museum of Comparative Zoology at Harvard University, sent me the material collected by Osten Sacken in 1876 (26 specimens, in seven species). Prof. Trevor Kincaid, of the University of Washington, sent his entire collection in the genus, rich in Puget Sound material and containing males of two species not before seen. All of this material and much more borrowed in smaller lots I was allowed to take to Washington and study in connection with the United States National Museum types; so that I had about 400 specimens together, including types of all species but those in the University of Kansas, which I examined later. Even with this exceptional opportunity, I did not have material enough to fully settle the status of two or three species, which must await further collection of specimens. The names of collectors are mentioned in connection with the various species; my thanks are due to them, to the gentlemen above named, and to Profs. H. F. Wickham and S. J. Hunter, and to Mr. Frederick Knab, and Dr. L. O. Howard.

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[1] Aldrich, Ent. News, vol. 23, p. 159.

Tables of Species of Symphoromyia.

MALES.

1. Face, with long, erect pile on the sides.................................... 2.
   Face bare on the sides.. 8.
2. Proboscis slender, with narrow labella, as long as height of head (California). *cruenta* Coquillett.
   Proboscis normal, short, the labella fleshy................................ 3.
3. Third antennal joint concave in profile at apex, below the artista............. 4.
   Third antennal joint kidney-shaped as usual, hence convex.................. 7.
4. Sides of abdominal segment 2-4 broadly yellow in ground color (Puget Sound; California)..*sackeni*, new species.
   Sides of abdomen black.. 5.
5. Palpi and third antennal joint yellow or reddish; pile on head very dense and long, reddish (California)....................................*pilosa*, new species.
   Palpi and third antennal joint black.. 6.
6. Pile of sides of face and of first antennal joint very dense; fourth posterior cell closed or nearly so (California)...........................*barbata*, new species.
   Pile of moderate density; fourth posterior cell wide open or slightly narrowed (California; Washington)................................*johnsoni* Coquillett.
7. Fourth abdominal segment expanded below on each side, with a row of stiff black hairs along the projecting margin (Oregon; Washington—*comata* Bigot). *pachyceras* Williston.
   Fourth abdominal segment plain (Idaho; Washington).....*inquisitor*, new species.
8. Front and middle tibiae yellow.. 9.
   All tibiae black, knees narrowly reddish.................................... 12.
9. Halteres yellow (Pennsylvania; Alabama; New Hampshire; Ohio; New Mexico; Colorado; Utah; Montana; Idaho; Alberta—*flavipalpis* Adams)..*hirta* Johnson.
   Halteres infuscated .... 10.
10. Abdomen very shining (British Columbia; Washington; Oregon; California; Nevada—*picticornis* and *latipalpis* Bigot) ....*plagens* Williston.
   Abdomen opaque.. 11.
11. Small, light-colored species, the first antennal joint with mostly white pile below (New Jersey)..*cinerea* Johnson.
   Medium-sized species with black pile on the first antennal joint (California; Colorado—*fera* Coquillett) ....*trivittata* Bigot.
12. Body gray pollinose, opaque... 13.
   Body black, velvety, or shining.. 14.

13. A distinct median gray line divides the broad, central dark-brown stripe of the mesonotum (California) .... *trucis* Coquillett.
The central stripe not so divided (Montana; Saskatchewan; New Hampshire). *montana*, new species.
14. First antennal joint greatly elongated and swollen, its vertical diameter over ¼ that of the head (British Columbia; Alberta; Washington; Montana; Colorado; Utah; California).......... *atripes* Bigot.
First antennal joint much smaller, its vertical diameter only about ⅙ that of the head.......... 15.
15. Rather velvet-black species, pile of abdomen yellow (British Columbia; Washington).......... *kincaidi*, new species.
Almost shining species, pile of abdomen black (Colorado)...... *pullata* Coquillett.

FEMALES.

1. Third joint of antenna concave at apex, below the arista.......... 2.
Third joint convex as usual.......... 5.
2. Abdomen yellow in ground color (Washington; California).. *sackeni*, new species.
Abdomen black.......... 3.
3. Sides of face with a little pile (Washington; California)....... *johnsoni* Coquillett.
Sides of face bare.......... 4.
4. Mesonotum with three brown stripes, all narrow and very distinct (California). *securifera* Coquillett.
Mesonotum with indistinct, broader, unequal stripes (Idaho; Montana; California). *inurbana*, new species.
5. Knob of halteres infuscated.......... 6.
Knob yellow.......... 11.
6. Abdomen shining black, broadly red at apex (California)...... *limata* Coquillett.
Abdomen not as indicated.......... 7.
7. Sides of face pilose.......... 8.
Sides of face bare.......... 10.
8. Proboscis slender, longer than height of head (California) ...... *cruenta* Coquillett.
Proboscis shorter, with broad, fleshy labella.......... 9.
9. Pale plumbeous species, the hairs above the notopleural suture white (Montana).......... *plumbea*, new species.
Much darker, the hairs above the notopleural suture black (Oregon; California; Montana—*comata* Bigot).......... *pachyceras* Williston.
10. Front above antennae as wide as the eye; tibiae black (Alaska; British Columbia; Alberta; Montana; Washington; Colorado; Utah; California)..... *atripes* Bigot.
Front above antennae much wider than the eye; tibiae yellow (Saskatchewan; Montana; California; New Hampshire) .... *montana*, new species.
11. Tibiae black, knees narrowly reddish.......... 12.
Tibiae yellow.......... 13.
12. Front above antennae about one-half wider than the eye (Idaho; Washington). *inquisitor*, new species.
Front above antennae about as wide as the eye (Washington; British Columbia). *kincaidi*, new species.
13. Abdomen shining reddish-brown except the first segment (British Columbia; Washington; Nevada—*picticornis* and *latipalpis* Bigot)...... *plagens* Williston.
Abdomen black in ground color.......... 14.
14. First antennal joint yellow, the rest black (California)........ *modesta* Coquillett.
First joint not paler than the others.......... 15.

15. Femora blackish (Pennsylvania to California., etc.—*flavipalpis* Adams).
hirta Johnson.
Femora yellow.. 16.
16. Pile of front and of mesonotum coarse and long, black (Colorado)..*fulvipes* Bigot.
Pile of front short, black, that of mesonotum largely white (New Jersey).
cinerea Johnson.

SYMPHOROMYIA ATRIPES Bigot.

Symphoromyia atripes Bigot, Bull. Soc. Zool. France, vol. 12, 1887, p. 15, female. Mount Hood, Oregon.

Male.—Wholly black except the knees, which are narrowly red, and the stems of the halteres, which are yellowish-brown; moderately shining on thorax and abdomen, the mesonotum a little less so, inclining to velvety on the middle, unstriped; first antennal joint greatly swollen.

Eyes not quite contiguous, vertical triangle with moderate black pile, frontal one bare, black; first antennal joint long and greatly thickened, especially bulging below, with dense, long black pile all round; the second and third joints wanting in the specimen; face bare, black; palpi large, prominent, and densely bushy black pilose; proboscis short, labella fleshy. In a slanting transmitted light there is a reddish tinge to the apical part of the hairs in the beard, and those on the palpi and the underside of the antenna.

Thorax seemingly not at all vittate, the pile blackish; hypopleura with tuft of pale pile. Abdomen with pale loose pile on sides near base. Femora and tibiae rather shining. Wings slightly tinged with brown, the base yellow.

Female.—Black, including antennae, palpi, halteres except the stalk, legs, and tarsi; moderately cinereous pollinose except the second, third, and fourth abdominal segments and the femora and tibiae, which are shining. Front black, cinereous opaque, very wide above on account of the compound eyes being nearly globular in shape, pile of front short, sparse, black; antennae rather short, first joint hardly longer than the two following together, opaque, with short black hair all round, not much thickened; second small, black; third intensely black, a little deeper vertically than long, slightly prominent below the arista, the depth not much greater than that of the first joint, arista stout, short; palpi short, thick beyond the middle, black, bare above, with black hairs below; labella black; proboscis projecting diagonally downward, about as long as the face; the face cinereous, not appreciably yellow along the lower border; occiput a little protuberant, with black hairs above, yellow on the middle and lower part, the last long. Thorax cinereous opaque, with a wide double stripe nearly black on the middle of the mesonotum and wide single stripe each side abbreviated in front and interrupted at the suture; scutellum cinereous; hairs of thoracic dorsum black, sparse, and rather small; pleura thinly pollinose, subshining, almost bare, the metapleura with delicate long, pale hairs; halteres brownish-black, the stalk brownish-yellow. All the coxae with yellow hair, that of the middle ones mixed somewhat with black; femora and tibiae moderately shining, hind femora on inner side polished. Abdomen wholly black, venter the same; hairs of abdomen dense and pale on the sides at base, elsewhere short and mostly black. Wings distinctly and uniformly infuscated, stigma brown, long, extending from before the apex of the auxiliary almost to the apex of the second vein.

Length of male, 8 mm.; of female, 5.3 mm.

Material examined:

One male, Webber Lake, California, July 26, 1876.

Bigot's type female, Mount Hood, Oregon.

Sixty other females, distributed as follows: Douglas, Alaska (in Melander's collection); Bear Lake (Currie, Caudell), Stickeen River Canyon (Wickham), Kaslo (Caudell), Mount Cheam (J. Fletcher), all in British Columbia. Lake Louise, Alberta (C. S. Minot, in C. W. Johnson's collection). Longmires Springs (J. M. A.), Ashford (Dyar and Caudell), Olympic Mountains (Kincaid), all in Washington. Collins, Idaho (Melander). Midvale (in C. W. Johnson's coll.), and Gallatin Valley (Cooley), in Montana. Webber Lake, California, July 21, 1876 (Osten Sacken). Emigration Canyon, Utah (A. K. Fisher). Rabbit Ear Pass, Colorado (in Melander's coll.); Longs Peak Trail, Colorado (Cockerell), and simply Colo. 2019, from the Agricultural College in the United States National Museum.

I associate this male with Bigot's species because there are no indications to the contrary, and both sexes were collected by Osten Sacken at the same place only a few days apart. Strangely enough, nobody since his time appears to have obtained this species of female with any male. I thought for some time that the male which I have associated with *kincaidi* might belong here; but on examining Professor Kincaid's material it appeared that he had captured it with the other female.

This species is the bad biter *par excellence*, in my experience, as described in the introduction.

SYMPHOROMYIA BARBATA, new species.

Male.—An opaque black, moderately cinereous species with concave third joint, bushy pilose face, infuscated halteres, black femora, yellow tibiae, and a thornlike bunch of setae on middle coxa; fourth posterior cell nearly or quite closed in the margin.

Eyes contiguous, vertical triangle with long black pile, frontal bare, rather ashy; first antennal joint long, hardly swollen, black, cinereous, with long black pile which is longer above than below; third joint small, black, concave below arista and distinctly angulated below the concavity, its vertical diameter equal to that of the first joint, sides of face with very long, abundant black pile; palpi brown, with mostly yellow, bushy pile; proboscis short, labella fleshy; beard yellow on lowest part and behind proboscis, black and stubbly above.

Mesonotum opaque dark brown with a double median gray stripe, rather indistinct, and gray pollen along the edges; scutellum dark opaque brown; pile of dorsum long, mostly black except on the middle of the anterior part; pleurae opaque brownish, with abundant pale pile; halteres deeply infuscated, the stems somewhat paler.

Abdomen wholly black, rather velvety above, with long erect pale pile.

Front and middle tibiae with fine short erect hairs on the apical third, which continue on the first tarsal joint; front tibia widened at apex on inner side into a blunt angle; all the tibial spurs minute, almost imperceptible. Wings subhyaline.

Length, 7½ mm.

A single male, Claremont, California (C. F. Baker, No. 8271).

The species resembles *johnsoni*, but is darker in color, face about twice as hairy, beard blacker, fourth posterior cell closed, etc. The fourth cell is probably somewhat variable and possibly useless as a character, as in one wing it is not quite closed, in the other entirely so. From the small amount of material in hand of both species they appear to be sufficiently distinct.

Type.—In the author's collection.

SYMPHOROMYIA CINEREA Johnson.

Symphoromyia cinerea Johnson, Ent. News, vol. 14, 1903, p. 25, male and female. Near Long Branch, New Jersey.—Fletcher, 34th Rep. Ent. Soc. Ont., p. 98, occurs in Northwest Territory, Canada.

Male.—A small, ashy species with pale legs, the pile mostly whitish. Head pale ashy; eyes barely contiguous; antennae rather brownish-yellow, first joint of medium size, a little swollen, densely ashy pollinose, with sparse, long whitish pile; third joint kidney-shaped, its vertical diameter not more than that of the first joint; sides of face bare; palpi yellowish-brown, with white pile; proboscis broken off from the described specimen. Mesonotum pale cinereous, with traces of darker lines; pleurae and abdomen ashy, pile mostly pale; halteres broken off; coxae black in ground color, femora brown, tibiae and base of tarsi yellow; middle coxae without spines; hind coxae with small condyles on front. Wings subhyaline, veins yellow.

Female.—Small, ashy species with yellow legs, halteres, antennae and palpi. Front with short black hairs, longer at vertex; first joint of antenna short, cinereous, thickened beyond middle, with short black hair; third joint kidney-shaped, rather large, its vertical diameter somewhat more than that of the first joint; sides of face bare; palpi yellow, the upper edge brown at widest part; proboscis short.

Thorax with indistinct brown stripes; halteres yellow. Abdomen rather evenly cinereous with a tinge of yellow. Coxae black, cinereous, the front ones yellowish toward tip, femora, tibiae, and half or more of all the tarsi yellow.

Length of male, 5 mm.; of female, 5½ mm.

One male and one female, cotypes, Long Branch, New Jersey; sent me by the describer, C. W. Johnson.

One female, Webber Lake, California, July 21, 1876 (Osten Sacken), agreeing exactly with the type female.

This is the smallest species, and one of the palest. Johnson gives the mesonotal stripes from better-preserved specimens as follows: "Three obscure brownish stripes, the wide dorsal stripe divided anteriorly by a fine hair line, the sub-dorsal stripes divided at the transverse suture forming two oblong spots; a small obsolete spot also present above base of the wing."

Three shriveled males, Washington, District of Columbia, May 12, 1895, are teneral, have been in alcohol, and are unrecognizable. In size they agree with *cinerea*. They have the halteres infuscated. On account of these specimens, I have ventured to place the species in the section of the table of males having this character. If it proves to be valid, there will be one good mark of distinction between *cinerea* and *hirta*. Under the latter species I have discussed the relations of these and allied forms.

SYMPHOROMYIA CRUENTA Coquillett.

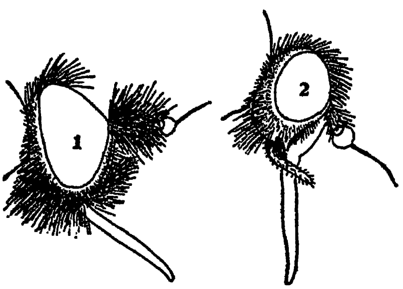
Symphoromyia cruenta Coquillett, Journ. N. Y. Ent. Soc., vol. 2, 1894, p. 55, male and female. Los Angeles County, California.

Male.—Black, opaque, the proboscis and legs shining; proboscis slender, longer than height of head, with narrow labella; sides of face pilose; hair everywhere black.

Eyes separated by more than the width of the lower ocellus; frontal triangle cinereous; first antennal joint cinereous, long, much swollen, tapering toward tip, with long and dense black pile; third joint small, rounded, its vertical diameter about ⅔ that of the first joint; sides of face bushy black pilose; palpi rather long and slender, black pilose; proboscis as mentioned. Thorax opaque black, from the expansion of the usual black stripes, so that the only cinereous portions are around the edges, a hair line in the center, and a wider line on each side of this; pile long and black; metapleural pile also black; halteres black, the stem brownish-yellow in the middle. Abdomen opaque black, black pilose, the incisures shining. Front and middle knees narrowly red; middle coxae not with spines; hind coxae with rather long, conical condyles. Wings uniform light brown.

Female.—Yellowish-brown pollinose, mesonotum with brown stripes, proboscis as in male.

Front with dense black pile, long for a female; first antennal joint rather large, with long black pile; third rounded or heart-shaped, vertical diameter slightly more than that of first joint; sides of face with mixed black and pale pile; beard light yellow; palpi black, with mixed hairs. Mesonotum with four brown stripes, the middle pair separated by a hair line, the outer notched at suture; a distinct brown spot above root of wing; hairs of thorax mostly black, those of metapleura, however, pale; halteres with blackish knob. Abdomen opaque yellowish-gray on black ground-color, with yellowish hairs. Femora and tibiae shining black, front and middle knees narrowly reddish.



FIGS. 1-2.—HEAD OF SYMPHOROMYIA CRUENTA 1, MALE; 2, FEMALE. ×11.

Length of male, 7 mm.; of female, 7–8 mm.

In addition to the long series of typical specimens of both sexes in the United States National Museum, I have seen five males from San Diego, California, collected by Prof. R. W. Doane.

SYMPHOROMYIA FULVIPES Bigot.

Symphoromyia fulvipes BIGOT, Bull. Soc. Zool. France, vol. 12, 1887, p. 14, female. Mount Hood, Oregon.

Female (type redescribed).—Black in ground color, brownish-cinereous pollinose, the following parts yellow: antennæ except arista, palpi, lower edge of face, halteres, sixth and following segments of the abdomen, femora, tibiae, and almost the whole of all the tarsi; comparatively coarse and strong black pile on the front, first antennal joint, palpi, mesonotum, scutellum, and middle coxae; abdomen with short blackish pile, yellow at base and on sides.

Front above antennae evidently narrower than one eye, with rather long, dense black pile; first antennal joint pollinose, not very decidedly yellow, short and a little rounded, with rather short black pile above and below; third joint deep yellow, convex at apex, its vertical diameter 1½ times that of first joint; sides of face bare, several small black hairs scattered on the lower half of the middle area of the face; proboscis short, labella thick and fleshy, the hard parts protrude farther than the palpi, equalling about ½ the height of the head; beard whitish.

Mesonotum brownish-cinereous pollinose, with three deep-brown stripes, very ill-defined in the specimen; the black pile above notopleural suture and on scutellum erect and conspicuous; pleurae subshining, with mostly delicate, pale hair; halteres entirely deep yellow.

Abdomen entirely brownish-cinereous pollinose, the ground-color changing to yellow in the latter part of the fifth segment.

Front and hind coxae with yellow pile; middle coxae slightly yellow at tip.

Wings slightly and uniformly yellowish-brown.

Length, 5.6 mm.

In his 1894 paper Coquillett placed this species as a synonym of *latipalpis* Bigot (=*plagens* Williston); but he evidently receded from this opinion later, as in the United States National Museum collection I found a row of 8 females bearing the name *fulvipes* in Coquillett's handwriting. They are very close to the type in their characters, but on account of their having much shorter pile on the front, lighter pollen on mesonotum, and other slight discrepancies, I did not feel sure of the identity, but consider them to belong to *hirta*.

From its early date *fulvipes* is without question a valid species; it is closely allied with *hirta* and *cinerea*, one or both of which may ultimately prove to be synonyms of it. No western males of the group are yet in collections, as far as I have seen; in a considerable number of females (about 36) from the West, there seems to be much variation in the amount of yellow in the antennae, and in the femora, etc.; none of them agree entirely with the type of *fulvipes*, and I believe they mostly go in *hirta* quite readily; however, the distinctions between *hirta* and *cinerea* almost or quite vanish in a large series, and I doubt if both can be maintained unless it shall be proved that the halteres of the male *cinerea* are infuscated, of which there is some prospect, as I have indicated under that species.

SYMPHOROMYIA HIRTA Johnson.

Symphoromyia hirta JOHNSON, Ent. News, vol. 7, 1897, p. 120. Philadelphia, Pennsylvania (one male, two females).—ADAMS, Kans. U. Sci. Bull., vol. 2, 1904, p. 439 (*flavipalpis*). Wasatch Mountains, Utah; Colorado (a female from each locality).

Male (type redescribed).—A robust black cinereous species with bare face, convex third antennal joint, yellow halteres, black femora and yellow tibiae.

Eyes barely contiguous, vertical triangle with very long, abundant black pile; frontal triangle bare, cinereous; first joint of antenna black, cinereous, very little swollen, with long black pile above and below; second and third joints missing (according to Johnson they were dark brown); face bare; palpi blackish, with bushy whitish pile like the beard; proboscis short, fleshy.

Mesonotum black, cinereous, somewhat glaucous, with three ill-defined wide blackish stripes, narrowed behind; pile bushy and black; scutellum glaucous, with very long erect black pile; pleurae blackish, with thin pollen and rather abundant delicate pale pile; halteres wholly yellow.

Abdomen black, with glaucous pollen and long bushy pile, which is yellow at base and on the sides, black on most of the dorsal surface; hypopygium somewhat embedded.

Coxae and femora black, tibiae and base of tarsi dark yellow; middle coxae with mixed black and yellow hairs, no spine.

Wings rather pale yellow.

Length, 7.5 mm.

Female (cotype redescribed; variations noted below).—Front cinereous, overlaid with brown pollen in the middle, with moderate black pile; width of front above antenna rather less than that of the eye; first joint of antenna yellowish-brown in ground color, cinereous pollinose, short and hardly swollen, with rather short black hair, that on the lower side slightly reddish; palpi wide toward the tip, dark yellow, brown on the bare upper edge before apex, the pile elsewhere mostly pale, but varying to blackish near the tip with the angle of view; proboscis short; labella fleshy; beard whitish.

Mesonotum and abdomen as in male, but with shorter pile; sixth and following segments brownish-yellow.

Legs and wings as in the male.

Length, 6.6 mm.

Material examined:

Type male and cotype female, Edge Hill, Philadelphia, lent by C. W. Johnson.

3 males, Mount Washington, New Hampshire (Slosson); 1 male, 2 females, Pennsylvania, in the United States National Museum.

3 females, Pennsylvania (Daecke); these have the tibiae dark, in one the hind tibiae quite black, but the middle and front ones are decidedly not black.

1 female, Ira, Summit County, Ohio (Hine); like the dark form just mentioned.

1 female, Thomasville, Alabama, lent by United States National Museum.

1 female, Wasatch Mountains, Utah, cotype of *flavipalpis* Adams, lent by C. W. Johnson; the legs are quite pale, femora deep brown toward base, antennae and palpi rather pale yellow.

1 female, Emigration Canyon, Utah, in the Wasatch Mountains (A. K. Fisher), is just a shade darker than the preceding.

6 females, Marshall Pass, Colorado, 10,856 feet, collected by me, are about as dark as Dr. Fisher's specimen.

8 females, Sedan, Montana (R. A. Cooley, No. 143); they have the femora black except tip, tibiae yellow, antennae from brown to black, palpi from yellow to black. These are the specimens mentioned in the introduction as sucking blood.

5 females, from Spanish City, West Gallatin Canyon, and Gallatin County, Montana, from Professor Cooley.

1 female, Nigger Hill, Montana, from Professor Melander, collected by W. M. Mann.

1 female, Collins, Idaho (Melander).

1 female, Big Horn, Wyoming, lent by United States National Museum.

2 females, Banff, Alberta (J. Fletcher), lent by Dr. C. Gordon Hewitt.

1 female, "Walrand Ranche, north of Pincher," lent by Dr. Hewitt.

2 females, "Colorado," lent by United States National Museum from a series of 8 in one lot, which are standing under the name *fulvipes* Bigot, determined by Coquillett. The femora are brown except apically.

1 female, Logan, Utah (Agr. Coll.).

1 female, Brightons, Utah; 1 female, Beulah, New Mexico (United States National Museum).

1 female, Longs Peak Trail, Colorado (Cockerell).

Under the names (chronologically arranged) of *fulvipes, hirta, cinerea,* and *flavipalpis,* we have to do with a series of female specimens from the east and all over the west, agreeing in having black, cinereous color, third antennal joint convex, face bare, and tibiae yellow or at least not black. No males have ever been assigned to *fulvipes* and *flavipalpis;* in *cinerea* only the type male has been found, which lacks the halteres; in *hirta* I have seen half a dozen eastern males. Not a single western male assignable to one of these species has come to light.

These females vary (in lots taken at the same time) in the coloration of the antennae, palpi, and legs, as well as in minor characters, to such a degree that it seems at present impossible to decide as to the number of species. I have examined type material in all four of the nominal species, and in both sexes where both where described, and have redescribed the same with care, except in the latest one, which I feel sure will fall under one of the others. I am inclined to lump all four under the oldest name, but can not see my way to do so in the absence of western males. Then again, there is a slight probability that the male of *cinerea* has infuscated halteres, which would give that species one definite character.

To sum up the principal slight differences which appear to justify the recognition of three specific names for the present:

Fulvipes.—The single female type has wholly yellow femora like female *cinerea,* but has longer black pile on front and thorax than I find in any other females in the whole mass of material I have examined.

Cinerea.—Femora wholly yellow, pile of thorax short and largely pale, that of front very short though black.

Hirta.—Femora varying from black to reddish, but always decidedly brownish or darker on the basal half.

Flavipalpis type is about halfway between the two preceding, but the femora are dark, and another specimen from about the type locality has them still darker, hence I place the name provisionally as a synonym of *hirta.*

Montana differs in having infuscated halteres in both sexes; the females of the preceding have yellow halteres.

SYMPHOROMYIA INURBANA, new species.

Female.—A smallish black species, densely gray pollinose, with yellow palpi, front and middle tibiae and halteres; face bare; third antennal joint concave below arista.

Front barely as wide as one eye, cinereous, with short, blackish pile; first antennal joint short, small, with short black pile; second half as long as first; third black, concave below arista, its vertical diameter almost equal to the whole length of the antenna to base of arista; face bare, cinereous; palpi yellow; broad beyond middle, with whitish hairs; proboscis short, labella fleshy; beard white.

Mesonotum densely pale ashy pollinose, with mostly pale pile including that above notopleural suture, vittae very indistinct; pleurae ashy, with pale pile; scutellum ashy with mostly pale pile; halteres wholly light yellow.

Abdomen wholly black in ground color, densely pollinose, a little more yellow than the thorax; pile mostly pale, not long.

Femora black, tips yellow; all the coxae and femora with pale pile, base of front tarsi distinctly yellow, others less so.

Wings almost hyaline with yellowish veins.

Length, 5.5 mm.

Seven females: Four from Hailey, Idaho (one of which is the type); one each from Webber Lake, California, July 21, 1876 (Osten Sacken); Placer County, California (Doane); and Gallatin County, Montana (Harold Morrison).

In the group of species with third joint concave below arista only three are known in the male sex, all of which have the sides of the face pilose; it would appear that the male of this species must be still unknown. The nearest relative known is *securifera,* which has a strikingly vittate thorax.

Type.—In the author's collection.

SYMPHOROMYIA INQUISITOR, new species.

Male.—Wholly black except the front and middle knees.

Eyes separated by twice the width of the lower ocellus; frontal triangle almost silvery in certain lights; first antennal joint long and greatly swollen, cinereous pollinose, and with long, bushy black hair;

second minute; third small, kidney-shaped; sides of face with long, dense black pile, becoming paler below the eye on the bucca; palpi with dense black pile. Mesonotum in well-preserved specimens dark cinereous, with four velvet-black stripes, the inner pair close together, the outer interrupted at the suture, or the anterior half indistinct; in abraded specimens the opaque black color remains; pleurae dark cinereous; pile of thorax almost wholly blackish. Abdomen opaque black above, cinereous below, the pile whitish except near apex; fifth and sixth segments not very narrow, tapering gradually. Wings uniformly subinfuscated.

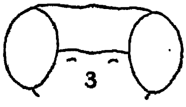


FIG. 3.—OUTLINE OF FRONT OF HEAD OF S. INQUISITOR FEMALE, TO SHOW WIDTH OF FRONT.

Female.—Head, thorax, and abdomen cinereous, except four dark stripes on mesonotum; palpi, middle, and front knees reddish; halteres yellow.

Front with short black pile; first antennal joint of medium size, a little swollen, cinereous, with short black pile above, pale below; third joint rather large, kidney shaped, its vertical diameter a little greater than that of the first joint; sides of face with rather abundant whitish pile; palpi yellowish to red, generally dark along lower edge, with pale hairs; proboscis short, labella fleshy. Pile of mesonotum largely black, of remainder of body mostly yellow, wings subhyaline, veins yellowish near base.

Length of male, 5½ mm.; of female, 4¾–5¾ mm.

Forty-five specimens, both sexes; collected about Pullman, Washington (type locality), and Moscow, Idaho, by Professor Melander and myself; one is from Juliaetta, Idaho.

The female appears to differ uniformly from *pachyceras* in having pale halteres; I find very little to separate the males.

Type.—In the author's collection.

SYMPHOROMYIA JOHNSONI Coquillett.

Symphoromyia johnsoni COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, 1894, p. 54, male and female (the female is a different species, here described as *kincaidi*, new species). Washington.

Male.—Ground color black, cinereous pollinose, abdomen darker above, mesonotum with three brownish stripes; tibiae and base of tarsi yellow, femora brownish.

Head cinereous, eyes contiguous below ocelli; first antennal joint ashy, not much thickened, with long, dense black pile; second minute; third small, concave in profile below arista and somewhat angulate on lower part; sides of face with strikingly long black hairs, not very dense; palpi a little yellow at tip, with dense whitish pile; beard whitish; proboscis short, the labella fleshy.

Thorax with three indistinct brown stripes; pile of thorax and scutellum rather mixed and changeable from brown or black to yellow; halteres black with yellow stem.

Abdomen narrow, opaque, darker above, with pale hairs, which become woolly on the sides; principal hooks of the hypopygium are yellow to piceous.

Coxae and femora black; middle coxa with several stiff, blunt bristles at tip, curved backward and united to form a thornlike structure.

Wings slightly infuscated toward the tip.

Length 6½ mm.

Female (not of Coquillett).—Black in ground color, but with pale cinereous pollen, the palpi, halteres, and front and middle tibiae yellow. Front with short black hair; first joint of antenna very short, with short black hair; third large, concave in profile below arista, its vertical diameter fully equal to the length of entire antenna from base to origin of arista; sides of face only slightly hairy; palpi bright yellow, broad near tip, with short pale hair; proboscis fleshy, shorter than height of head.

Thorax and abdomen rather uniform gray pollinose, with short pale hair, which, however, becomes blackish on the mesonotum and scutellum; halteres wholly yellow.

Femora blackish, tibiae yellow, the hind ones darker.

Wings hyaline, stigma and the veins of the basal half yellow.

Length 6 mm.

One pair, male and female, Pasadena, California, collected by F. Grinnell, jr.; one male, Ormsby Co., Nevada (Baker). I also compared the single male type in the United States National Museum.

Coquillett named the species after Prof. O. B. Johnson, who was for a long time a teacher in the University of Washington and an enthusiastic collector of the animal life in and about Puget Sound, but who has now for some twenty years been on the retired list on account of ill health; although necessarily living a secluded life, Prof. Johnson still retains a keen interest in his insect collections, and is visited for inspiration and instruction by the younger biologists of the Northwest. I note these facts as a tribute of respect and affection.

SYMPHOROMYIA KINCAIDI, new species.

Symphoromyia kincaidi Coquillett, Journ. N. Y. Ent. Soc., vol. 2, 1894, p. 54 (the female as *johnsoni*, new species). Washington; British Columbia.

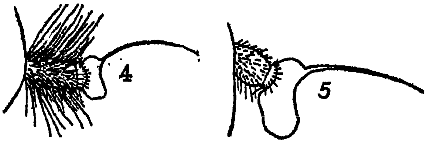
Male.—Black, opaque above, pile of thorax and head mostly black, of abdomen largely yellow; front and middle knees narrowly red; face bare; middle coxae without curved, thornlike bunch of spines.

Eyes barely contiguous; first antennal joint rather long, moderately swollen, with dense long black pile; second minute; third small, kidney-shaped, vertical diameter a little less than that of the first joint; sides of face bare, beard brownish or yellowish; palpi black, with dense black pile, rarely a little paler; proboscis small, labella fleshy. Thorax velvet black, without stripes, hair almost all black, a tuft of yellow on the smaller calypter; halteres black. Abdomen velvet black above, shining on incisures when they are a little extended, in side view mostly shining. Hind coxae with condyles. Wings uniformly infuscated, rather dark.

Female.—Black, head and thorax cinereous, the latter with black stripes, abdomen shining; face bare, palpi black to red or even yellow; halteres yellow.

Front with dense black pile; first antennal joint hardly longer than the two following together, swollen, black pilose; second slightly larger than usual; third kidney-shaped, vertical diameter about one-third more than that of first joint; beard yellow. Thorax with a double median dark stripe and a poorly defined one each side, pile mostly black; halteres yellow. Abdomen shining black except first joint and apex, which are opaque; hair of abdomen short, yellow. All the coxae with yellow hair. Wings uniformly infuscated, not so dark as in male.

Length of male 6 mm.; of female 5½–6 mm.



FIGS. 4-5.—OUTER SIDE OF RIGHT ANTENNA OF S. KINCAIDI. 4, MALE; 5, FEMALE. ×20.

Material examined—Males:

9 from Kanaka Bay, San Juan Island, Washington, collected by myself on foliage in the sun, May 31, 1906 (type-locality, type in author's collection).

2, Coupeville, Washington, June 23, 1907 (Kincaid).

1, Skokomish River, Washington, June 22, 1912, B. Elliott (Kincaid).

1, Victoria, British Columbia, Aug. 6, 1903 (Kincaid).

1, Gabriola Island, British Columbia, May 30, 1908, B. Elliott (Kincaid).

?1, Pacific Grove, California, Mar. 20, third joint of both antennæ gone (R. W. Doane).

?1, Blue Mountains, southeast Washington, July 15, 1896, a teneral specimen with slightly reddish legs (R. W. Doane).

Females:

4, Stickeen River Canyon, British Columbia (Wickham).

1, Friday Harbor, San Juan Island, Washington, June 2, 1906 (J. M. A.).

1, Olga, Orcas Island, Washington, July 15 (Melander).

3, Coupeville, Washington, June 23, 1907 (Kincaid).

1, Olympia, Washington (Kincaid).

2, Ashford, Washington, Dyar and Caudell (U.S.N.M.).

3, Longmires Springs, Mount Rainier, Washington, Aug. 2, 1905 (J. M. A.).

2, Washington (Piper and Kincaid).

3, Washington (O. B. Johnson), and 2, Stickeen River, Canada (Wickham), in the United States National Museum (Coquillett's type material of *johnsoni*, female).

A single female, in bad condition, from Sheep Creek, Alaska, differs only in having entirely yellow pile all over, quite long on the front. It may be a different species. It is from Professor Melander's collection.

The female of the species described above is undoubtedly Coquillett's *johnsoni;* whether I have been any more successful than Mr. Coquillett in associating the correct male with it may possibly be questioned. From the fact that Professor Kincaid collected both sexes on the same day at Coupeville, Washington, I conclude that they belong together.

I found *kincaidi* along with *atripes* Bigot in the Mount Rainier National Park in 1905, but did not at the time notice that there were two species; later I found that my notes about the biting habit were attached to *atripes,* but I am under the impression that *kincaidi* is an almost equally bad biter.

I have followed the usual procedure in retaining Mr. Coquillett's name for the male of his composite species.

SYMPHOROMYIA LIMATA Coquillett.

Symphoromyia limata COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, 1894, p. 54, female. Southern California.

Female.—A rather large blackish species, the antennae, palpi, and tibiae yellow; abdomen shining black on first four segments, the remainder red.

Front narrower than the eye, rusty cinereous, the short black pile arising from minute black dots; antennae bright orange, rather small, inserted far apart; first joint with short black pile, third kidney-shaped, its vertical diameter 1½ times that of the first segment; face with very scattered and small pile, hard to see, yet important as indicating that the male, as yet unknown, has a pilose face; lower margin of face reddish; palpi orange red, bare on a large part of the upper surface, with small blackish hairs otherwise; proboscis with the horny part longer than usual, yet much shorter than height of head; labella soft, fleshy; beard light yellow.

Mesonotum black, with thin pollen, a broad median darker stripe bordered by a cinereous line each side; pile short, blackish, arising from minute dots; pleura subshining black, with a tuft of pale pile on propleura and another on hypopleura; halteres with infuscated knob.

Abdomen: First segment concolorous with scutellum, a row of appressed pale hairs on its hind margin; segments 2, 3, and 4 shining black and almost bare of hairs; 5 and following red; venter concolorous with dorsum.

Coxae and femora black, subshining, the knees, tibiae, and base of tarsi reddish-yellow, hind coxae with distinct condyles fitting into middle coxae.

Wings brownish, darker toward the stigma.

Length, 8 mm.

Two females, Los Angeles County, California (United States National Museum, part of the original lot); 1 female same locality from Prof. R. W. Doane; four females from F. Grinnell, jr., San Bernardino Mountains, and San Jacinto Mountains, California.

The original type material consisted of 20 females from "Southern California;" no other specimens have been reported up to the present, the male being still unknown.

I examined the remainder of the United States National Museum series. This is perhaps the easiest of all the species to recognize.

SYMPHOROMYIA MODESTA Coquillett.

Symphoromyià modesta COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, 1894, p. 54, female. California.

Female.—Ashy gray, the halteres, legs, palpi, and first antennal joint yellow.

Front about as wide as one eye, opaque cinereous, with coarse black pile; first joint of antenna opaque çinereous on yellow ground color, with moderately long black pile; second and third joints black, the last kidney-shaped, its vertical diameter 1⅓ times that of the first joint; sides of face bare; palpi yellow with long black pile except at base where it becomes reddish and on a bare area on the curved upper surface; proboscis short, with black, thick labella; beard whitish.

Mesonotum opaque cinereous, with a broad median blackish stripe and two lateral ones on each side which unite in front of the suture; scutellum opaque, cinereous; pile of thorax and scutellum mostly black; pleurae darker, less pollinose; halteres light yellow.

Abdomen cinereous pollinose on a black ground color, with mostly pale pile, sixth and following segments reddish.

Coxae black, somewhat cinereous, with pale pile, trochanters black; femora, tibiae, and basal part of tarsi yellow.

Wings yellowish subhyaline, the venation as usual.

Length, 6.3 mm.

One specimen, Woodside, California (a few miles west of Redwood City), collected while I was on a short bicycle trip to view the effects of the famous earthquake of 1906; the date of collection was April 25, 1906, one week after the earthquake. Also one specimen collected by Osten Sacken, Sausalito, California, April 2, 1876.

The type material mentioned by Coquillett consisted of three females, collected in California in May; this I examined in the United States National Museum. The male has not yet been recognized. This is the only species yet known which has the first joint of the antenna paler than the following ones, although several species show the reverse coloration.

SYMPHOROMYIA MONTANA, new species.

Male.—A dark opaque species, thorax with three broad black stripes narrowed behind, abdomen opaque with brownish cinereous pollen; antennae black; face bare; halteres infuscated; legs except knees black (in female tibiae and base of tarsi yellow).

Head much wider than thorax; eyes not quite contiguous; ocellar triangle with black pile; frontal triangle bare; first antennal joint cinereous, long, swollen, with long black pile all round; third joint small, convex below arista, its vertical diameter two-thirds that of the first; palpi black with mixed but mostly black hairs; proboscis short, labella fleshy; beard long, whitish, the anterior part a little blackish.

Mesonotum as described, pile long, rather delicate, blackish; scutellum and pleurae dark cinereous, the former with erect black pile the latter with mostly whitish, some on mesopleura blackish; halteres with brown stem and blackish knob.

Abdomen rather robust, gray-brown, opaque, with long pale pile. Legs rather shining black, knees red.

Female.—Opaque yellowish-brown, thorax with three blackish stripes; front above antennae decidedly wider than the eye; abdomen long and broad; tibiae and base of tarsi yellow.

Front with short yellowish pile; first antennal joint short, black, yellowish pollinose, its pile short and mostly whitish; third small, black, convex below arista, its vertical diameter about equal to that of the first; face very broad, bare; palpi brownish-yellow with pale hairs; proboscis short, labella fleshy; beard pale yellow.

Thorax yellowish opaque (in well preserved specimens distinctly trivittate), with short yellowish pile; pleurae concolorous with pale pile; hatleres brown, with dark-brown knob.

Abdomen long and broad, uniformly yellowish-brown pollinose, with yellow pile. Femora black except apices, tibiae and base of tarsi yellow, hind ones somewhat darker than the others.

Length of male, 6.7 mm.; of female, 7.5 mm.

Males: Bozeman, Montana, July 20, 1906, R. A. Cooley (type); Armistead, Montana (Cooley); Prince Albert, June 18, 1905 (T. S. Willing); Ungava Bay, Hudson Bay Territory (Turner, in C. W. Johnson's coll.); Farewell Creek, South Saskatchewan (C. W. J.).

Females: Bozeman, Montana, June 18, 1913 (Cooley); Bozeman, Farewell Creek; also three females from White Mountains, New

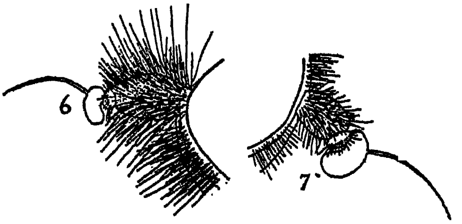
Hampshire, collected by Mrs. Slosson—these being the best preserved show the thoracic stripes very plainly.

There are several other specimens which I leave here provisionally. One male, Monida, Montana (Cooley), is very robust, first antennal joint greatly swollen, thoracic stripes unusually strong and black; another male, Gallatin Valley, Montana (Harold Morrison), has the tibiae distinctly yellow almost to the tip, thus approaching *trivittata*. It will require more material to explain all these differences.

SYMPHOROMYIA PACHYCERAS Williston.

Symphoromyia pachyceras WILLISTON, Trans. Amer. Ent. Soc., vol. 13, 1886, p. 287, male and female. Northern California.—BIGOT, Bull. Soc. Zool. France, vol. 12, 1887, p. 15 (*comata*). California.

Male.—Wholly black in color except narrowly on the knees, the inner parts of the proboscis, and the stems of the halteres, which are yellow, and the pulvilli, whitish. Opaque black pollinose on thorax except two cinereous lines on dorsum; abdomen opaque black; head a little cinereous.



FIGS. 6-7.—OUTER SIDE OF S. PACHYCERAS. 6, LEFT ANTENNA OF MALE; 7, RIGHT ANTENNA OF FEMALE. X20.

Front as wide at narrowest place as the anterior ocellus; antennae black, first joint cinereous, much thickened, with dense and long black pile; second and third joints very small, the last of the characteristic kidney shape. Face with dense and long blackish pile on the sides between the eye and the depression; palpi with dense and very black pile; proboscis fleshy, short; cheeks, occiput and ocellar triangle with long black pile.

Thorax and scutellum with long black pile above. Abdomen with mostly pale pile on the first four segments, which are almost of equal width, tapering but slightly, the fourth with its sternite flat, its projecting edges rounded behind and provided with a row of stiff black hairs; fifth segment much narrower and tapering; sixth minute; seventh with dense black hair below; hypopygium subshining black.

Legs rather shining black; middle coxae not with spines, but with rather coarse black hair about tip; hind coxae with a shining black tubercle on front side, small and hard to see.

Wings strongly infuscated, slightly less so behind.

Female.—Ground color as in male, stems of halteres paler. Cinereous pollinose; the front, three broad stripes on mesonotum not attaining the anterior margin, and most of the upper surface of the abdomen black or brown pollinose. Pile of front dense, black, long for a female; first antennal joint moderately enlarged, with almost as long black pile as the front; third antennal joint kidney-shaped, wider than the first joint; sides of face with shorter and less dense, erect black pile than in the male; palpi broad near tip (sometimes this is indistinct owing to the organ being shriveled), cinereous pollinose, with varying yellow and black pile. Proboscis about half as long as height of head, the inner organs usually projecting beyond the retracted labella. Thorax with black pile, that of the metapleura however conspicuously yellow; halteres yellow with black knob. Coxae except sometimes the middle ones with yellow pile. Wings very little infuscated, the veins yellow at base. Abdomen tapering, cinereous, dark above, the pile almost all yellow.

Length of male, 6 mm.; of female, 6–9 mm.

24 specimens, both sexes; 3 females, California (Bigot's type material of *comata*); Portola and Woodside, California (J. M. A.); San Geronimo and Sausalito, California (Osten Sacken); Stanford University (Doane); Humboldt County, California (U.S.N.M.); Corvallis, Oregon (Kincaid); Gallatin County, Montana (Cooley); Olympia, Washington (Kincaid); Williams, Arizona (U.S.N.M.).

The Arizona specimen bears the label "Biting." Riley and Johannsen[1] state on the authority of Dr. J. C. Bradley that *pachyceras* is "a vicious biter."

I have seen the types of Williston's description. Bigot was too hasty in admitting the synonymy of *trivittata*, which has a bare face, though Bigot described it as hairy.

SYMPHOROMYIA PILOSA, new species.

Male.—A slender species with yellow antennae, palpi, and legs except femora, characterized by long and abundant pale pile, that of vertex, antennae, and sides of face reddish; third antennal joint concave below arista; middle coxae with long, curved, thornlike cluster of bristles.

Eyes narrowly contiguous below ocelli; first antennal joint of medium length, a little swollen; third axe-head-shaped, the edge downward, vertical diameter slightly greater than that of first joint, arista wholly yellow; sides of face very pilose; palpi yellow, with reddish-yellow dense pile; proboscis short, the labella fleshy; beard yellowish-white.

Mesonotum cinereous for a broad space in the median part, reddish laterally; the color of the long pile varies much in different lights, yellow or red or blackish; scutellum brown on disk, with the blackest pile of the whole body; pleurae reddish-brown, the propleura, mesopleura, and hypopleura with abundant pale pile; halteres with infuscated knob.

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[1] Medical Entomology, 1915, p. 112.

Abdomen elongate, reddish at base, gradually becoming black near tip, opaque throughout, with pale pile.

Legs yellow, femora more or less reddish or brown; tarsi sometimes yellow to the tip, sometimes more or less infuscated on apical segments; middle coxa with a striking long black curved thorn as in *securifera*, but even larger, composed of at least a dozen bristles closely united, and of jet black color, contrasting strongly with the rest of the coloration.

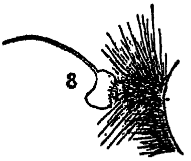


FIG. 8.—OUTER SIDE OF LEFT ANTENNA OF S. PILOSA, MALE. ×20.

Wing rather uniform yellow, veins yellow, stigma dark yellow.

Length, 7.6 mm.

Three specimens, Palo Alto, California, July 5, 1895; collected by R. W. Doane. (Type returned to Professor Doane).

I strongly suspect that the specimens have been faded from prolonged exposure to light, and the colors are not quite as they would be in fresh specimens; it may even be that the reddish pile will be found to be normally black. In any event, the species will be readily recognized by the pale antennae with concave third joint, thorn on middle coxa, etc.

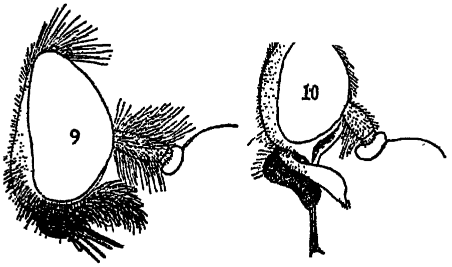
The female is unknown.

SYMPHOROMYIA PLAGENS Williston.

Symphoromyia plagens WILLISTON, Trans. Amer. Ent. Soc., vol. 13, 1886, p. 287, male. Washington; Mount Hood, Oregon.—BIGOT, Bull. Soc. Zool. France, vol. 12, 1887, p. 12, female (as male, *latipalpis*); p. 13, male (*picticornis*). Washington.

Reported from Ormsby County, Nevada (Baker); Beulah, New Mexico (Skinner); and British Columbia (Hine).

Male.—Black, including first two joints of antennae, arista, palpi, knobs of halteres, and femora; third joint of antenna orange yellow; tibiae and base of tarsi pale yellow. Eyes barely contiguous in the middle of the front, front destitute of hairs except in the ocellar triangle and behind it, above the antennae whitish pollinose and bare; first joint of antenna long (double the two following combined), moderately thickened, cinereous pollinose, with dense and long black hair which is slightly longer above; second joint concolorous, very short; third joint small, bare, about the same in vertical diameter as the first joint, orange yellow with a blackish arista, below which it is convex; sides of face hairy about up to the middle (not shown in the figure, as the hairs are sparse and delicate); palpi cylindrical, long, with bushy black hair; labella small, proboscis shorter than the palpi; occiput not much protuberant, above with a row of long, erect black hairs, on the lower part the hair is slightly mixed with paler. Thorax cinereous opaque above, denser in front, the hairs black except about the humeri; scutellum concolorous; pleura concolorous, with black hairs except in front of the halteres, which are yellowish with infuscated knob. Abdomen wholly shining black, with conspicuous, woolly, reddish hair nearly to the tip, more distinct on the sides; on the apical part with black hair. Front coxae with black hair, and the same on the sternopleura behind it; hairs of middle coxae long and woolly, black for the most part, but somewhat pale at tip; hind coxae with yellow hair; all the tarsi infuscated from about the middle of the second joint. Wings infuscated, somewhat more densely across the middle, with a whitish or subhyaline streak between the first and second veins, from their fork to the stigma. Length 8 mm.



FIGS. 9-10.—HEAD OF S. PLAGENS. 9, MALE; 10, FEMALE. ×11.

Female.—Head, thorax, and coxae black, overlaid with yellowish pollen; abdomen chestnut-brown; antennae, palpi, femora, and tibiae yellow. Front broad, with nearly parallel sides, with moderate black pile, the black ground color generally completely obscured with pollen, but in some specimens that are abraded there are shining spots like those of *Tabanus;* first antennal joint opaque, not much longer than the two following, with black hairs which are short above and long and sparse below near the tip; second joint yellow, with a circle of black hairs; third joint bright orange yellow, bare, of typical kidney shape, vertical diameter nearly a half greater than that of the first joint at widest; lower edge of face yellow in ground color nearly to the eye; palpi deep orange, widened upward past the middle and bare on this part, the hairs on basal and underside mixed yellow and black, tip somewhat pointed; labella large and soft, the proboscis projecting diagonally downward about as long as the face or slightly more; occiput with black hair above, yellow behind, becoming bushy below. Mesonotum densely pollinose, a slender ill-defined median line blackish, pile mostly black, longer above the notopleural suture and before the scutellum; pleurae with soft pale hair, the black ground color showing through on lower half; metapleura with pale long hair. Legs yellow almost to the tips of the tarsi, the coxae and the anterior trochanters black; front and hind coxae with yellow pile, middle ones with mostly black coarse hair; scutellum protuberant, concolorous with thorax, with moderate and mostly black hair. Abdomen chestnut-brown, the first and second segments black at the sides, and the former with long and abundant pale hair at the sides; metathoracic epimera (the ridge from hind coxae joining it with first abdominal segment) black; venter black at base, the rest chestnut-brown; most of the abdominal pile yellow. Wings subhyaline, a slight infuscation extending longitudinally across the small cross vein.

Length of male, 8 mm.; of female, 5.5–7 mm.

Material examined: Bigot's types of *latipalpis* and *picticornis*, one specimen of each, from Washington; four males from Professor Kincaid, taken at Gabriola Island, British Columbia, Rocky Point, British Columbia, Skokomish River, Washington, and Seattle; and 41 females. The females are from the following places: Gabriola Island, British Columbia (Kincaid); Friday Harbor (J. M. A.), Coupeville, Olympia, and Seattle (Kincaid), in Washington; Corvallis, Oregon (Kincaid); Humboldt County, California (E. C. Van Dyke, in the National Museum coll.); Ormsby County, Nevada (Baker in Doane's coll.). I have also seen Williston's types.

Bigot received Williston's paper while his own was going through the press, and attached a note acknowledging the synonymy of *picticornis* with *plagens*.

SYMPHOROMYIA PLUMBEA, new species.

Female.—Head, thorax, and abdomen black, covered with smooth leadcolored pollen; antennae and legs black, knees red; pile almost entirely white except on the front and partly on first antennal joint and scutellum; sides of face pilose.

Front nearly 1½ times as wide as one eye, with long black pile; first antennal joint concolorous with head, short and thick; third joint kidney-shaped, vertical diameter hardly more than that of first joint; sides of face with very delicate but rather abundant pale pile; palpi small, yellowish, with white hairs; beard and occipital hair white.

Mesonotum with rather plentiful pale pile, a few hairs on scutellum black; entire knob of halteres distinctly infuscated; pleurae concolorous with dorsom.

Abdomen wholly leadcolored, as described.

Legs black, knees narrowly red.

Wings whitish hyaline, veins dark brown.

Length, 5 mm.

A single specimen, Bozeman, Montana, June 12, 1903; from Professor Melander's collection.

Type.—In the author's collection.

SYMPHOROMYIA PULLATA Coquillett.

Symphoromyia pullata COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, p. 56, 1894, male.

Coquillett's original description is here given in its entirety:

Male.—Black, including palpi and halteres. Pile also largely black, that in front of halteres and on sides of first abdominal segment sometimes largely whitish. Face, bare; proboscis retractile, scarcely one-half as long as the palpi. Head and body subshining, not gray pollinose, thorax not vittate. Coxae as in *trucis* ("hind coxae produced near the apex in front in the form of a rounded knob; pile of middle coxae short, not forming pencils"). Wings grayish-hyaline, slightly yellowish along the costa, stigma dark-brown. Length 7 mm. New Hampshire (Mrs. A. T. Slosson) and Colorado. Two males.

To this I can add the following: The New Hampshire specimen has been removed, and the type label is on the Colorado specimen. The only males from New Hampshire that I found in the collection were a set of *hirta,* with yellow halteres; as these have Mrs. Slosson's name on them, I incline to the opinion that Coquillett afterward discovered that his two specimens were of different species, and removed the New Hampshire specimen to *hirta.* The expression "sometimes largely whitish," referring to the pile of the sides of the first abdominal segment, evidently applied to the specimen which was removed. The table of species indicates the relationship to *kincaidi;* the differences are not great, but with so great difference of locality and a single specimen of *pullata* I could not venture to assert the identity of the species. I have seen no specimens which seem to belong with Coquillett's Colorado type.

SYMPHOROMYIA SACKENI, new species.

Male.—Black, the following parts yellow: tips of femora, all the tibiae, tarsi to the middle, venter except near tip, three pairs of coalescent spots on the sides of the abdomen, and the halteres except a part of the knob; third antennal joint concave below the arista. Eyes contiguous for a space about equal to the length of the ocellar triangle, frontal triangle almost silvery pollinose; antennae of moderate length for the sex, first joint hardly twice the length of the two following, densely cinereous pollinose, with long but not dense black hair, about of equal length above and below; second joint concolorous, with short hair; third joint more brown than black, concave on apex with an angle above and one below apically, the arista arising from the former; the lower part of this joint is larger than the upper and the vertical diameter is a third more than that of the first joint; face with a row of long black hairs close to the eye, extending nearly up to the antenna; palpi short and slender, black with mostly whitish hairs; labella very small and proboscis shorter than the palpi; occiput with black hairs, a few long ones above, those below a little mixed with yellow. Thorax above cinereous pollinose, but with some indistinct longitudinal markings of browner pollen, the hairs of the disk mostly pale yellow, those around the edges coarser and black; pleura concolorous, with mixed hairs, those of metapleura long and pale yellow; halteres yellow, but the knob largely blackish; scutellum rounded, with mixed hairs. Abdomen long and slender, the hair wholly yellow except at tip; color rather opaque black, except the venter on the basal and middle parts, and four pairs of spots on the sides, which are yellow; hypopygium prominent, black. Front coxae with black and yellow hairs, those of middle coxae black, not spine-like, of the hind ones yellow. Wings moderately infuscated, darker in the middle, the stigma large, deep brown.

Female.—Black, all the following parts yellow: abdomen except basal part of venter; tip of front coxae, apical half of middle ones, all of hind ones; femora, tibiae, and nearly half of all the tarsi; antennae, palpi, and halteres. Third antennal joint concave in profile below the arista.

Front ochraceous pollinose, with short black pile; first antennal joint small, short, with short black pile; second minute; third very large, almost orange yellow; vertical diameter 2½ times that of first joint, concave in profile below arista, which is concolorous at base; side of face with a few small pale hairs on upper part, hard to see; palpi concolorous with third antennal joint, of moderate size, with pale hair; proboscis yellowish brown, fleshy, short. Mesonotum and scutellum ochraceous pollinose, with mixed black and yellow short pile; pleurae dark cinereous pollinose; metathoracic epimera yellow (above hind coxa, connecting with abdomen). Abdomen opaque dark yellow hairs, black toward tip. Wings subhyaline, a little yellowish.

Length of male, 7¾ mm.; of female, 6–7 mm.

Thirteen males, 14 females: East Sound, Washington (Kincaid); Friday Harbor, Washington (J. M. A.); Sonoma County, California, July 4, 1876 (Osten Sacken, 11 specimens, both sexes); Kern County (Coquillett) and Mountain View (Ehrhorn), California (both in the U.S.N.M.); San Gabriel Mountains, California (F. Grinnell, jr.). Type in Museum of Comparative Zoölogy, Harvard University, Cambridge, Massachusetts.

SYMPHOROMYIA SECURIFERA Coquillett.

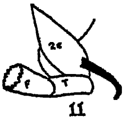
Symphoromyia securifera COQUILLETT, Proc. Ent. Soc. Wash., vol. 6, 1904, p. 171, female. Santa Clara County, California.

Female.—A pale cinereous species with the halteres, third joint of antennae, and palpi yellow; legs mostly yellow; third antennal joint concave in profile below arista; face bare; mesonotum with three very distinct narrow brown stripes, the middle one not at all divided.

Front narrower than one eye, densely ashy pollinose, indistinctly marked with brown before the ocelli, the pile short and black; first joint of antenna short and rounded, not longer than the two following, yellowish, with small black hairs; third joint yellow, its vertical diameter slightly more than double that of first joint, concave in profile below arista, which is yellow at its extreme base; palpi pale yellow, with small, pale hairs; proboscis with blackish, fleshy labella; beard white, the hairs of the occiput also white up to the about the vertex.

Thorax pale cinereous, densely pollinose, dorsum striped as above mentioned; scutellum faintly brownish on the disk, elsewhere as the mesonotum; pile of thorax mixed with pale, that above notopleural suture wholly white; halteres pale yellow; pleurae and coxae densly ashy pollinose.

Abdomen concolorous with pleurae, a slight indication of a median brown line; pile mostly white. Femora brownish-red, tibiae yellow, tarsi gradually darker beyond about the middle. Wings nearly hyaline, veins pale at base, stigma brown, venation normal.



11

FIG. 11.—OUTER SIDE OF RIGHT MIDDLE COXA OF S. SECURIFERA, SHOWING SPINE-LIKE AGGLOMERATION OF BRISTLES. C, COXA; F, FEMUR; T, TROCHANTER.

Length, 5 mm.

One specimen collected by Osten Sacken, Sonoma County, California, July 6, 1876. The male is unknown. The species is peculiar in the strongly developed, narrow dark-brown lines of the thorax; other species have fainter grayer lines, and as far as I have noted the middle one is either double or much wider than in this case.

I examined the single female type in the United States National Museum; it agrees perfectly, showing also the beginning of a stripe on the abdomen.

SYMPHOROMYIA TRIVITTATA Coquillett.

Symphoromyia trivittata BIGOT, Bull. Soc. Zool. France, vol. 12, 1887, p. 13, male. Colorado.—COQUILLETT, Journ. New York Ent. Soc., vol. 2, 1894, p. 56, male (*fera*). Colorado.

Male.—(Bigot's type.) The specimen is in fine condition, but has lost the third antennal joint on the right side and part of the right front tarsus. Comparing with Bigot's description, the palpi have pale hair except about the tip; the face is bare, only the bucca having the cinereous villosity; there is no black hair on front except on ocellar triangle; and the tibiae are more decidedly yellow than indicated. Nevertheless, the three brown stripes of the mesonotum are so distinct that no doubt can exist that this is Bigot's type-specimen, and the original label in Bigot's writing is attached to it.

Bigot himself[1] stated that *trivittata* is a synonym of *pachyceras*, and the statement has been accepted up to the present; it is, however, a mistake. Depending upon Bigot's disposition of his own species, and especially upon the statement that *trivittata* has a pilose face, Coquillett naturally failed to recognize the species, and redescribed it under the name of *fera*, as I found by placing the two types side by side at the United States National Museum.

Eyes barely contiguous, frontal triangle bare, cinereous pollinose; antennae black, first joint cinereous, swollen, long, with long blackish hair above and below; third joint small, convex below the arista, its vertical diameter hardly as much as that of the first joint; face bare, very deeply grooved; palpi black, with long pale hairs, mostly changing to black near the tip; beard pale; behind the compound eyes above is a considerable fringe of erect black hairs, about 15 each side of the vertical triangle; proboscis short, labella fleshy.

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[1] Bull. Soc. Zool. France, vol. 12, 1887, note following p. 22.

Thorax cinereous, with three well-developed dark-brown stripes, the middle one three or four times as wide as the gray space separating it from the lateral stripe; pile blackish, but much of it pale in some lights; pleurae cinereous, with pale pile above, that on mesopleura kinky; scutellum cinereous, brownish on disk, with long coarse quite black hair; halteres with brownish-yellow stem and dark-brown knob. Abdomen wholly densely pollinose except where the segments are a trifle pulled apart, more yellowish in color than the thorax, pile nearly all yellowish-white. Femora black, the tips narrowly yellow; tibiae yellow, but little darkened toward the tips; anterior tarsi a little yellow at base only; coxae black, front and hind ones with only pale hair, middle with black hair but no thornlike group of setae. Wings evenly subinfuscated, veins brown, stigma brown.

Length, 8 mm.

Besides the types of Bigot and Coquillett, a single specimen each, and both of them males from Colorado, the only material I have seen of this species is a set of four males collected by Osten Sacken at Webber Lake, California, July 27, 1876. The female must be very similar to that which I have described under *montana*, new species.

SYMPHOROMYIA TRUCIS Coquillett.

Symphoromyia trucis COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, 1894, p. 55, male. Southern California.

The entire original description by Coquillett is as follows:

> *Male.*—Black, including the palpi and knob of halteres, only the tibiae sometimes yellowish. Pile of head and thorax largely black, that of the abdomen yellowish-white. Face bare; proboscis retractile, scarcely one-half as long as the palpi. Head and body opaque, gray pollinose; thorax marked with three lighter vittae. Hind coxæ produced near the apex in front in the form of a rounded knob; pile of middle coxae short, not forming pencils. Wings grayish, stigma brown. Length. 7 mm. Southern California, in April and May.

I can add from examining the types that they are rather dirty specimens; the one with the yellowish tibiae is teneral, and I should say that dark brown or black is the normal color of the tibiae; the mesonotum has such wide blackish vittae that the intervening gray color is a narrow line; the middle stripe of blackish is divided by a gray line in the best-preserved specimen, so that the mesonotum might be called blackish, with three gray lines and gray edges. I had no males that would match this species.

THE GENERA AND SUBGENERA OF RACCOONS AND THEIR ALLIES.

By N. Hollister,

Assistant Curator, Division of Mammals, United States National Museum.

The family Procyonidæ offers a remarkable instance of a group of mammal genera in which the differentiation in the structure of the teeth throughout the series is nearly uniform in degree from genus to genus, and strictly definite in direction from one extreme to the other. This condition is particularly interesting because of the wide difference between the teeth of genera from the extremes of the line, and because the widely diverse cranial and external characters show no special tendency toward serial grouping. Eliminating the very aberrant *Bassariscus*, which clearly does not belong in this series of genera, the superspecific groups remaining within the Procyonidæ, when based chiefly on dental characteristics, fall into as well-ordered a sequence of steps, connecting the Old-World *Ailurus* with the American *Potos*, as it would seem possible to find among living animals. (Plate 39.)

The one seemingly aberrant cranial feature in *Ailurus*,[1] the presence of the alisphenoid canal, can not in this case be considered a character of family or subfamily importance. The alisphenoid canal in other families of carnivores is known to be absent or present in different genera, in individuals of the same species, or even on the right and left side of the same individual. Of the American groups, *Euprocyon* is the nearest approach to *Ailurus*, but if the genera within the family are to be kept of fairly uniform value and degree of differentiation, *Euprocyon* is surely not more than a subgenus of *Procyon*. The small mountain forms of coati mundis, including *Nasua olivacea* Gray and its subspecies, differ so greatly from all the other members of the genus *Nasua* as to require generic separation. They show strong resemblances in several cranial and dental characters to *Bassaricyon*.

The cacomistles (*Bassariscus*), while exhibiting many of the characters of the Procyonidæ differ so greatly in the nature of all the teeth that it seems impossible to retain them in the family. The dog-like premolars and molars, the rounded canines, and the evident though small secondary lobes on the incisors (particularly noticeable in *B. sumichrasti*, which has been made the type of a separate subgenus "*Jentinkia*") all show unmistakable characters of the teeth of the Canidæ. It seems necessary, therefore, to place them in a separate family, as was done by Gray in 1869[1] and by Gill in 1872.[2]

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[1] For the loan of a skull of *Ailurus*, I am indebted to the Academy of Natural Sciences of Philadelphia, through Dr. Witmer Stone.

The arrangement of the superspecific groups usually placed in the Procyonidæ would be then:

Family BASSARISCIDÆ.

1. **BASSARISCUS** Coues.
   (syn., *Jentinkia* Trouessart.)

Family PROCYONIDÆ.

1. **AILURUS** Geoffroy and Cuvier.
2. **PROCYON** Storr.
   a. **EUPROCYON** Gray.
   b. **PROCYON.**
3. **NASUA** Storr.
4. **NASUELLA**, new.
5. **BASSARICYON** Allen.
6. **POTOS** Geoffroy and Cuvier.

The genera and subgenera of the family Procyonidæ may be diagnosed as follows:

Genus AILURUS Geoffroy and Cuvier.

1825. *Ailurus* Geoffroy and Cuvier, Hist. Nat. Mamm., vol. 5, livr. 50, text panda, p. 3. June.
1841. *Arctaelurus* Gloger, Gemeinn. Hand- und Hilfsb. Naturg., vol. 1, pp., xxviii and 55 (1842).
1846. *Aelurus* Agassiz, Nomencl. Zool., Index, p. 9.

Type.—[*Ailurus*] *fulgens* Geoffroy and Cuvier.

Characters.—Face short, head roundish; ears large, erect, pointed; tail long, nonprehensile; claws semiretractile; sole of foot almost entirely haired; os penis small (23 mm. in length), not bilobed anteriorly.

Skull short, high, and rounded; rostrum short; braincase high and narrow, interorbital constriction comparatively great; zygomata without distinct postorbital processes; sagittal crest well developed. Palate highly arched, grooved medially, and extending only little beyond plane of last molar; vomer not attached to palatal bones; alisphenoid canal present; foramen ovale large; postglenoid process heavy, high, and greatly arched forward; audital bullæ very small, inflated only on inner side, the external auditory meatus a long and narrow tube. Mandible short, greatly rounded; ascending ramus high, wide, and curved backward; condyles very large.

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[1] Bassaridæ, Gray, Cat. carn., pachyd., and edent. mamm., p. 246. 1869.
[2] Bassarididæ, Gill, Smiths. Misc. Coll., No. 230, p. 7, 59, 67. 1872.

Dental formula.—$i\frac{3}{3}\,c\frac{1}{1}\,pm\frac{3}{4}\,m\frac{2}{2}=38$.

Cheek-teeth large, maxillary row about one-third greatest length of skull; molariform teeth comparatively high crowned, multicuspid; last upper premolar and upper molars much broader than long; pm^4 nonsectorial. Incisors weak. Canine ovate in section at cingulum, grooved on outer and inner surfaces. Each upper premolar with more than one cusp; pm^3 with well developed protocone and hypocone; pm^4 six-cusped, the protocone and hypocone with the prominent supplementary inner cusp forming more than one-half the tooth; pm_1 minute and deciduous; permanent lower premolars all long and narrow. Upper molars usually with numerous accessory cusplets on outside and on the strongly developed inner cingulum shelf; lower molars with numerous accessory cusplets. (Plate 39.)

Genus PROCYON Storr.

1780. *Procyon* STORR, Prodr. Meth. Mamm., p, 35.

(FULL SYNONYMY UNDER SUBGENERA.)

Type.—*Ursus lotor* Linnæus.

Characters.—Head broad behind, with pointed muzzle; ears fairly large, pointed; toes all free; claws nonretractile; tail shorter than body, nonprehensile; soles of feet entirely naked; os penis long and slender, about 100 mm. in length, bilobed anteriorly.

Skull more elongate (less rounded) than in *Ailurus*, shorter and broader than in *Nasua;* braincase broad and flat, with medium interorbital constriction; zygomata with distinct postorbital processes, but processes from frontals greatly reduced; sagittal crest moderate or absent. Palate flat or slightly concave, extending considerably beyond plane of last molar, and with barely noticeable lateral grooves; vomer attached to palatal bones; alisphenoid canal absent (as in all succeeding genera); foramen ovale small; postglenoid process small; audital bullæ large, greatly inflated on inner side, and not rising at sharp angle above the tube of the external auditory meatus. Mandible long, moderately rounded; ascending ramus low and extending backward without a highly arched curve; condyles small.

Dental formula: $i\frac{3}{3}\,c\frac{1}{1}\,pm\frac{4}{4}\,m\frac{2}{2}=40$.

Teeth large (maxiliary row about one-third greatest length of skull); molariform teeth comparatively high crowned, with heavy, conical cusps; last upper premolar and first upper molar subquadrate, only slightly broader than long, or both dimensions about equal; pm^4

subsectorial. Incisors heavy, normal, crowns slightly grooved in unworn condition. Canine ovate at alveolus, slightly grooved on edges of outer surface and flattened on inner surface. First upper premolar single-rooted, second and third two-rooted, fourth three-rooted; pm^3 unicuspid, with well-developed cingulum shelf; pm^4 five-tuberculate, with only rarely an indication of supplementary inner cusplet; lower premolars more rounded, less lengthened, than in *Ailurus*. Upper molars usually without accessory cusplets, except on posterior border of inner cingulum shelf of m^1, which is much less developed than in *Ailurus*; first lower molar large, with heavy conical cusps.

Subgenus **EUPROCYON** Gray.

1864. *Euprocyon* GRAY, Proc. Zool. Soc. London, 1864, p. 705.
1913. *Euprocyon* GOLDMAN, Smiths. Misc. Coll., vol. 60, no. 22, p. 16, February 28.

Type.—*Ursus cancrivorus* Cuvier.

Characters.—Pelage short; hair reversed from withers to between ears; claws heavier, straighter, broader, and more bluntly pointed than in true *Procyon;* os penis only slightly bowed, without sharply recurved distal end.

Skull essentially as in true *Procyon,* but with bony palate extending backward beyond plane of last molar a distance less than one-fourth the entire length of palate.

The teeth of *Euprocyon,* though obviously most resembling those of *Procyon* proper, show some tendencies of differentiation toward *Ailurus*. Third upper incisor with posterior fold little developed. The upper molariform teeth are broader, with better developed cingulum shelves and heavier, more rounded-coniform cusps; pm^4 has the deep valley between the paracone and hypocone not crossed by a connecting ridge, the hypocone standing as an isolated cusp; m^1 distinctly five-tuberculate (a well-developed protoconule present), with additional accessory cusplet on posterior border of inner cingulum. (Plate 39.)

Subgenus **PROCYON** Storr.

1780. *Procyon* STORR, Prodr. Meth. Mamm., p. 35.
1795. *Campsiurus* LINK, Beytr. Naturg., vol. 1, pt. 2, p. 87 (type, *Ursus lotor* Linnæus, now selected).
1795. *Lotor* GEOFFROY AND CUVIER, Mag. Enc., 1795, vol. 2, p. 187.
1816. *Loter* OKEN, Lehrb. Naturg., 3ter Theil., 2te Abth., p. 1080.
1899. *Mamprocyonus* HERRERA, Sin. Vulg. Cient. Vert. Mexicanos, p. 18.

Type.—*Ursus lotor* Linnæus.

Characters.—Pelage longer than in *Euprocyon;* hair of neck not reversed; claws lighter, strongly curved, and sharply pointed; os penis strongly bowed and sharply recurved at distal end.

The bony palate extends backward beyond plane of last molar a distance greater than one-fourth the entire length of palate, usually nearly one-third.

Posterior fold of third upper incisor commonly developing a small, independent cusp. Upper molariform teeth smaller and weaker than in *Euprocyon*, scarcely broader than long, with less developed cingulum shelves, and more sharply, less rounded, coniform cusps; paracone and hypocone of last upper premolar connected by a low ridge; m^1 four-tuberculate, the summit of protocone long, oblique, and not divided; and posterior border of cingulum shelf connected with crown of hypocone, without accessory cusplet. (Plate 39.)

Genus NASUA Storr.

1780. *Nasua* Storr, Prodr. Meth. Mamm., tab. A.
1799. *Coati* Lacépède, Tabl. Mamm., p. 7.
1845. *Nasica* South, Encycl. Metr., vol. 7, p. 383.
1872. *Cuati* Liais, Clim., Géol., Faune Brésil, p. 427.
1899. *Mamnasuaus* Herrera, Sin. Vulg. Cient. Vert. Mexicanos, p. 26.

Type.—*Viverra nasua* Linnæus.

Characters.—Head long, rostral portion elongated, the snout upturned and mobile; ears rather short, rounded; tail very long, usually longer than body, nonprehensile; soles of feet naked; toes united for some distance from bases; front claws very long, slightly curved; hind claws strong, sharp, and well curved; os penis about 75–85 mm. long (according to Flower).

Skull long and comparatively narrow, the rostrum elongated and laterally compressed; braincase less flattened than in *Procyon*, with very little interorbital and considerable postorbital construction; zygomata with or without postorbital processes, frontals with distinct processes; sagittal crest well developed. Palate flat, or hollowed posteriorly, with distinct lateral grooves, and extending far beyond plane of last molar; palatine bones deeply notched on each side, with long processes extending laterally to the maxillary tuberosities; posterior root of last molar near line with center of orbit; vomer usually attached to palatal bones; foramen ovale small; audital bullæ small but smoothly rounded, and rising at sharp angle from tube of external auditory meatus. Mandible essentially as in *Procyon*, but ascending ramus comparatively small and low.

Dental formula: $i\,\frac{3}{3}\,c\,\frac{1}{1}\,pm\,\frac{4}{4}\,m\,\frac{2}{2}=40.$

Teeth of medium size, much smaller than in *Procyon*, much larger than in *Nasuella* (maxillary row less than one-third the greatest length of skull, the uninterrupted series, pm^2-m^2, usually more than one-fourth the greatest length, always more than one-fourth the occipito-nasal length); crowns comparatively high, with sharp, strong cusps; pm^4 slightly longer than broad; m^1 subquadrate, length and breadth about equal, or sometimes longer than broad;

*pm*⁴ nonsectorial; molariform teeth with inner cingulum undeveloped and supplementary or accessory cusplets almost entirely wanting. Incisors lighter and weaker than in *Procyon*, the upper central pairs in line and in contact, the fronts of outer (i^3) back on level with posterior border of alveoli of middle incisors and separated from the middle pairs by a considerable diastema; lower incisors protruding forward. Canines much compressed laterally, the points turned outward. Premolars all two or three rooted; first three premolars single cusped, the middle two with wide cingulum shelf and heel; pm^4 with very well-developed hypocone. (Plates 38 and 39.)

NASUELLA, new genus.

Type.—*Nasua olivacea meridensis* Thomas.

Characters.—In general like *Nasua*, but smaller, with much shorter tail. Compared with *Nasua*, the skull of *Nasuella* is small and weak, the rostrum long and slender with the middle greatly constricted laterally. The palate extends still farther beyond plane of the last molar; the palatine bones are fan-shaped anteriorly and completely fill the space to the maxillary tuberosities; the molar-premolar row is so shortened that the posterior border of the last molar lies on a line with the most anterior border of orbit, leaving the maxillary tuberosity as a long shelf; audital bullæ small and flattened. Mandible lightly built, the ascending ramus short.

Dental formula: $i\,\frac{3}{3}\,c\,\frac{1}{1}\,pm\,\frac{4}{4}\,m\,\frac{2}{2}=40.$

Teeth all greatly reduced in size and approaching in many characters the teeth of *Bassaricyon;* relatively and actually much smaller than in *Nasua*, *Bassaricyon*, and *Potos;* low crowned and sharply cusped, decidedly of a general insectivorous type; pm^4 nonsectorial; maxillary row, without the disconnected pm^1, less than one-fifth the greatest length of skull; maxillary teeth all longer than broad; diastema between incisors and canine proportionally greater than in *Nasua*, between canine and pm^1 and between pm^1 and pm^2 very much greater; lower premolar series also much interrupted. Incisors as in *Nasua*, but outer (i^3) farther back from posterior alveolar plane of central four; and lower row much more protruding, the teeth almost horizontal, and on a line parallel with alveolar line of mandibular tooth row. Canines excessively flattened, saberlike, and outwardly bowed. First two upper premolars compressed cones, third with postero-internal shelf; fourth with three cusps only, the hypocone wanting. First upper molar subquadrate, four-cusped; very little larger than m^2. Lower molars much compressed, of nearly equal size. (Plates 38 and 39.)

Genus BASSARICYON Allen.

1876. *Bassaricyon* Allen, Proc. Acad. Nat. Sci., Philadelphia, 1876, p. 20.

Type.—*Bassaricyon gabbii* Allen.

Characters.—Form elongated, head flattened, muzzle pointed; ears rather small, rounded; tail longer than head and body; posterior half of soles of feet furred; toes semipalmate; claws short, sharply curved and sharply pointed; os penis small, 32 mm. in length, slightly bowed, and much less distinctly bilobed anteriorly than in *Procyon* or *Euprocyon.* The general external appearance of the animal is remarkably like that of *Potos.* The best distinguishing external characters are the gray face and the less fully haired, less tapering, tail of *Bassaricyon.*

Skull short and broad; braincase much as in *Procyon,* but considerably smaller; rostral portion depressed as in *Nasua* and *Nasuella,* but much shorter; postorbital processes well developed from frontals and zygomata; orbits large; temporal ridges never forming a sagittal crest. Palate flat, with shallow lateral grooves, and extending well backward; vomer not attached to palatal bones; posterior half of audital bullæ greatly inflated, anterior half low and flattened; tube of external auditory meatus very short. Mandible light, the ascending ramus long and high.

Dental formula: $i\frac{3}{3}\,c\frac{1}{1}\,pm\frac{4}{4}\,m\frac{2}{2}=40.$

Teeth somewhat larger than in *Nasuella,* the large cheek-teeth low crowned and only slightly cusped; teeth closely set, incisors all in contact and the upper cheek teeth uninterrupted from canine to m^2. Lower incisors nearly normal, not produced forward as in *Nasuella.* Canines comparatively large, not excessively flattened; the upper pair nearly straight and not outwardly bowed. Premolars almost exactly as in *Nasuella,* but less compressed laterally. First upper molar somewhat larger than second; each with three low, rounded cusps, and well developed outer cingulum. (Plate 39.)

Genus POTOS Geoffroy and Cuvier.

1795. *Potos* Geoffroy and Cuvier, Mag. Enc., 1795, vol. 2, p. 187.
1799. *Kinkajou* Lacépède, Tabl. Mamm., p. 7.
1805. *Caudivolvulus* Dumeril, Zool. Analyt., p. 14 (1806).
1811. *Cercoleptes* Illiger, Prodr. Syst. Mamm., p. 127.
1813. *Kinkaschu* Fischer, Zoognosia., ed. 3, vol. 1, p. 14.
1815. *Aesurus* Rafinesque, Analyse Nat., p. 59.
1899. *Mamcercolepteus* Herrera, Sin. Vulg. Cient. Vert. Mexicanos, p. 19.

Type.—*Viverra caudivolvula* Schreber.

Characters.—Form elongated; head rounded, muzzle pointed; tail very long, prehensile; ears short; posterior half of soles densely furred; claws short, sharply pointed; fingers and toes partially webbed; limbs short.

Skull short, rounded, and highly arched; rostrum short and broad; braincase large, sharply constricted in the postorbital region (in fully adult skulls the postorbital constriction is greater than interorbital constriction); postorbital processes well developed from frontals, only slightly so from zygomata; sagittal crest usually developed on forward half of braincase. Palate flat, short, and extending posteriorly only short distance beyond plane of maxillary tuberosities; audital bullæ much flattened, about equally inflated anteriorly and posteriorly. Mandible heavy, the ascending ramus high, straight, and little produced backward.

Dental formulæ: $i\,\frac{3}{3}\;c\,\frac{1}{1}\;pm\,\frac{3}{3}\;m\,\frac{2}{2}=36.$

Teeth, excepting m^2, larger than in *Bassaricyon*, flatter, lower crowned, and still less tuberculated; entire row interrupted only by very short incisor-canine diastema. Incisors heavy, broad; the outer pair proportionately much larger and deeply emarginate over the posterior cingulum fold; lower incisors with chisel-shaped crowns, the central pair small. Canines large, much flattened, and emarginate on inner surfaces, and deeply grooved on outer sides; nearly straight. Premolars all large, the first two (pm^2 and pm^3) simple, with blade-like, crested crowns; pm^4 very broad, a long lateral shelf to the single internal, low and rounded cusp. First upper molar about twice the size of second, subquadrate, and almost flat except for outer raised rim; m^2 and both lower molars slightly sculptured and virtually without tubercles. (Plate 39.)

EXPLANATION OF PLATES.

PLATE 38.

Skulls of *Nasuella* and *Nasua* (natural size).

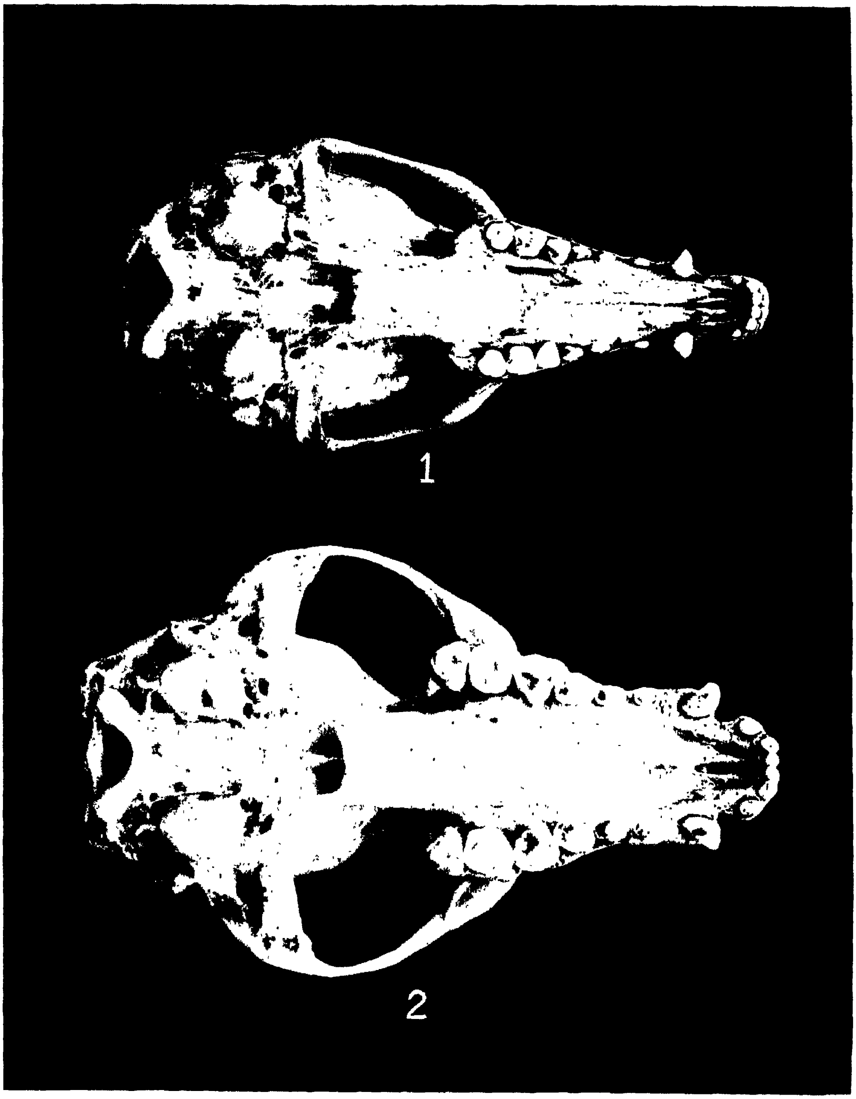
FIG. 1. *Nasuella olivacea meridensis*, Cat. No. 143658, U.S.N.M.
2. *Nasua nasua*, Cat. No. 61489, U.S.N.M.

PLATE 39.

Right upper tooth-rows of Procyonidæ.

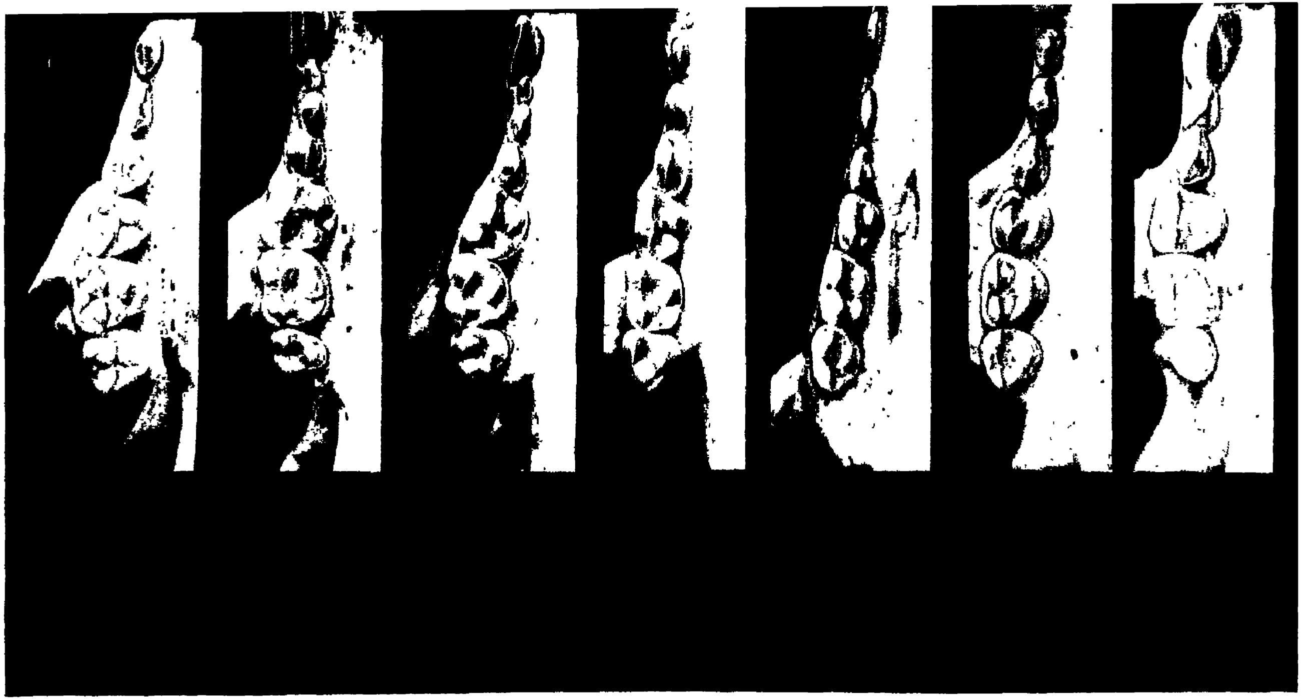
(To facilitate comparison of the important features of the crown patterns, these tooth-rows are figured at same size, based on length of the three large molariform teeth.)

Fig. 1. *Ailurus*, Cat. No. 12426, Acad. Sci., Philadelphia.
2. *Euprocyon*, Cat. No. 172987, U.S.N.M.
3. *Procyon*, Cat. No. 6025, U.S.N.M.
4. *Nasua*, Cat. No. 61489, U.S.N.M.
5. *Nasuella*, Cat. No. 143658, U.S.N.M.
6. *Bassaricyon*, Cat. No. 171138, U.S.N.M.
7. *Potos*, Cat. No. 74684, U.S.N.M



SKULLS OF NASUELLA (1) AND NASUA (2).

FOR EXPLANATION OF PLATE SEE PAGE 150.



Ailurus. *Euprocyon.* *Procyon.* *Nasua.* *Nasuella.* *Bassaricyon.* *Potos.*

TOOTH ROWS OF PROCYONIDÆ.

FOR EXPLANATION OF PLATE SEE PAGE 150.

NOTES ON THE FLIES OF THE GENUS PSEUDODINIA, WITH DESCRIPTION OF A NEW SPECIES.

By J. R. Malloch,

Of Urbana, Illinois.

In a synopsis of the genera of North American Agromyzidae in 1913 [1] I included the genus *Pseudodinia* in Octhiphilinae. I did so because I considered that the species had closer relationship to *Octhiphila* than to any other genus, and this view I still hold. Melander, in his synoptic review of Agromyzidae and Geomyzidae,[2] has placed the genus in Geomyzidae. From his own tables I gather that the reason for this can only lie in the presence of the mesopleural bristle and the color of the species. At least these are practically the only characters which prevent one using the subfamily key given by Melander from placing the species where they obviously belong. It is not necessary that I should lay stress upon the fact that neither of the characters above mentioned are of subfamily value. On page 225 of Melander's paper is given a tabulation of characters for the separation of the families Agromyzidae and Geomyzidae from allied families. In the first column it is indicated that the costa in Geomyzidae is once broken. *Pseudodinia* has no costal break, as is indicated in the generic table given in a subsequent part of the same paper. It is unnecessary that I should enter into a lengthy discussion as to the generic position of *Pseudodinia,* but in closing I may perhaps more readily impress upon the students the fact that the genus bears more than a passing resemblance to *Octhiphila* by stating that Coquillett, who described the genus, made the mistake of labeling a specimen in the United States National Museum collection "*Octhiphila* n. sp." This species I labeled provisionally "*Pseudodinia pruinosa* n. sp." but afterwards refrained from describing it because of certain facts subsequently discovered from an examination of a series of specimens in another collection.

The table given in my paper previously referred to will serve to correctly place the species of this genus generically. The species described herewith, while differing considerably in the chaetotaxy of the head, is in every other respect so obviously congeneric with *varipes*, the type of the genus, that I have no hesitation in placing it in *Pseudodinia*.

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[1] Proc. U. S. Nat. Mus., vol. 46, 1913, pp. 127-154.

[2] Journ. New Jersey Ent. Soc., vol. 21, 1913.

PSEUDODINIA POLITA, new species.

Female.—Glossy black. Head black; frons shining; arista yellowish at base; palpi brown; proboscis yellow. Body without pruinescence. Legs yellow; coxae brownish-black; femora, except the apices, black. Wings yellow at base, clear; veins brown. Squamae white, fringe concolorous. Halteres yellow, knob lemon-yellow, hairs and bristles black.

Frons about twice as long as broad, slightly narrowed anteriorly; postvertical bristles small; ocellar bristles very weak, lying close to surface of frons; the normal two pairs of orbital bristles very weak, almost indistinguishable, and placed far back on frons, the lower well above middle; transverse depression distinct and shallow; frontal triangle slightly indicated; antennae small, third joint rounded apically, slightly longer than broad; arista rather thick, tapering at base, almost bare; cheek linear, marginal hairs weak; vibrissae absent; eyes large, distinctly higher than long. Mesonotum with two pairs of dorso-centrals; discal setulae short and numerous, about 12 irregular rows between dorso-centrals; basal scutellar bristles weaker than apical; mesopleural bristle strong. Fore femora with black bristles on the postero-ventral surface; mid tibiae with apical spur; all tarsi slightly thickened. Wing veins 3 and 4 divergent apically; inner cross vein at middle of discal cell; last section of fifth vein about two-thirds as long as penultimate section of fourth; last section of fourth twice as long as preceding section; sixth vein to near wing margin. Length, 2.5–3 mm.

The male agrees with the female in color and chaetotaxy. The hypopygium is small and knoblike, turned down and slightly forward under the abdomen, and is in general appearance very much like that of *Agromyza parvicornis* Loew.

Type-locality.—Centerville, Illinois, August 17, 1914, by sweeping vegetation on the bank of the Sangamon River (C. A. Hart and J. R. Malloch). Paratype, Urbana, September 30, 1914 (J. R. Malloch). This species may be separated from the 3 previously described species by the entirely yellow tibiae. On September 30 I took a single female of *P. nitida* Melander at Urbana.

Paratype.—Cat. No. 19395, U.S.N.M.

A PECULIAR OOLITE FROM BETHLEHEM, PENNSYLVANIA.

By Edgar T. Wherry,
Assistant Curator, Division of Mineralogy and Petrology.

The material here described occurs in Lerch's quarry, on the west side of Monocacy Creek, one-quarter mile north of the northwest corner of the borough of Bethlehem, and a mile and a half north of Lehigh River, near the center of the Allentown quadrangle, in Northampton County, Pennsylvania. The rock quarried is a magnesian limestone belonging to the "Allentown" formation, which represents the Upper Cambrian (Ozarkian) in this region.

A variety of geologic phenomena is exhibited at the locality. In the southern portion of the quarry the beds are thrown into a fine anticline, the north limb of which is cut by a vertical fault marked by brecciation and shearing of the rock. In the northern part the beds are steeply upturned, and show slickensides where they have slipped over one another. Tension cracks filled with secondary dolomite and quartz crystals are numerous, and a miniature cave containing tiny stalactites and beautiful twinned calcite crystals was at one time opened in the course of quarrying operations. Well-developed colonies of several types of cryptozoon, splendid ripple-marked surfaces, and strata crowded with oolite grains are also to be seen at various horizons.

In these oolitic beds the separate grains, or ooids, are usually from 1 to 1½ mm. in diameter, but occasionally attain 5 mm. They are normally spherical in shape, although elongated or irregular lumpy forms are not uncommon, especially among the larger ones. The color of the grains is usually a dark gray, and they stand out distinctly against the paler tint of the enclosing rock.

The details of their structure can best be seen when sections are examined under a low-power microscope. They sometimes show a distinct concentric arrangement of lighter and darker layers, with well-rounded grains of quartz or calcite as nuclei, but in most cases recrystallization has obliterated all traces of both nucleus and concentric rings. A carbonaceous pigment is usually visible, and minute irregular or subangular masses of limonite, probably pseudomorphous after pyrite, are dotted here and there, being especially abundant near the surfaces of the grains.

Proceedings U. S. National Museum, Vol. 49—No. 2102.

In one layer about 20 cm. in thickness, which has been removed from much of the quarry face, but is still (at time of writing) exposed in place at the extreme north end, the majority of the ooids show, when broken across, a remarkable "half-moon" aspect, being divided parallel to the bedding into a light and a dark portion, the latter being the lower. In most of them the light portion is the larger, but in rare instances the dark may occupy nearly the entire grain.

When examined under the microscope the dividing line between the two parts is found to be, as a rule, convex toward the white one, but in a few instances it is straight across, irregularly curved, or even slightly concave. The two parts are alike in crystallinity, both being much coarser than the ground-mass of the rock; the black pigment may be seen to spread in films between the individual crystals as well as to be enclosed by them. The nuclei occasionally remaining are no longer in the centers of the grains, but always well toward the bottom of the dark portions. The tiny specks of limonite are practically absent from the white portions, but are often present all the way around the dark ones.

Throughout the bed in which these "half-moon" ooids occur there are lens-shaped areas in which the grains are of the ordinary type. These lie in the centers of blocks formed by the intersection of bedding and joint planes. The ooids in them are also mostly recrystallized; but as a rule are not as coarse-grained as the divided ones.

Table of analyses.

	1.	2.	3.
CaO	33.10	30.40	......
MgO	17.84	19.71	......
FeO	0.25	0.11	......
CO_2	45.70	45.57	......
Al_2O_3	0.23	0.32	......
Fe_2O_3	1.33	1.90	......
SiO_2	0.52	0.68	......
H_2O	0.32	0.44	......
C	0.79	1.21	......
	100.08	100.34	......

Calculated mineral compositions.

	1.	2.	3.
Dolomite	81.65	89.98	73.32
Calcite	14.78	5.31	24.25
Siderite	0.40	0.18	0.62
Kaolin	0.58	0.80	0.36
Quartz	0.25	0.31	0.19
Limonite	1.55	2.21	0.89
Carbon	0.79	1.21	0.37
	100.00	100.00	100.00

1. Composition of the oolitic limestone.
2. Composition of the ooids which have weathered out.
3. Calculated composition of the matrix, assuming that the ooids make up about half the rock.

Although the rock has probably undergone some alteration since its original deposition, it seemed worth while to make an analysis of it, the results of which are given in column 1, above. This shows it to be a high-magnesian limestone. It is not possible to separate the ooids from the matrix in the fresh rock, but where slight weathering has taken place the ground-mass has become soft and sandy, and they stand out in relief and can readily be picked out. In the weathering process they have no doubt been altered slightly, so that their original composition is indeterminate, but an analysis, given in column 2, shows them to differ from the rock itself to a greater extent than can be accounted for by weathering.

Comparison of columns 2 and 3 in the table shows the ooids to be higher in dolomite, quartz, kaolin, limonite, and carbon, and lower in calcite and siderite than the matrix.

That quartz and kaolin should be higher is to be expected, for grains of these minerals acted as nuclei for the formation of the ooids in the first place. That carbon should be higher is also normal, for low forms of life no doubt took part in the deposition of the concentric coats of the carbonates.

The greater amount of limonite is probably to be correlated with that of carbon, for the former has been produced by the decomposition of pyrite, precipitated from circulating iron sulphate solutions by the carbonaceous matter. The reason for the greater amount of dolomite and smaller of siderite is discussed later.

The significance of practically all of the above-described features becomes evident when the probable mode of formation of the "half-moon" oolite is considered. When the ooids were first formed they no doubt consisted of aragonite, whereas the matrix was dolomite-mud. Mixed with the aragonite, in varying amounts in the different concentric layers, was the carbonaceous pigment. After the solidification of the sediment into rock and the development of joint cracks (but before the uptilting of the beds) waters penetrated along these cracks and along the bedding planes. Since aragonite is more soluble than the dolomite of the matrix, it dissolved away, leaving behind the carbon and the nuclei—sand grains and bits of kaolin—in some cases stripped of all concentrically deposited aragonite, in others still retaining a few layers. These settled to the bottom of the cavities in heaps, the shapes of which varied with the sizes of the nuclei and the stage in the solution process at which they fell into the masses of carbon powder.

At some later period water again traversed the rock, but this time conditions were favorable to deposition instead of solution, and secondary dolomite filled up all openings in the rock, tension and joint cracks as well as the holes left by the removal of the ooids. As is usual in the recrystallization of carbonate rocks this secondary material tended to approach the normal dolomite ratio, although as the analysis shows, a slight isomorphous admixture of calcium and ferrous carbonates still remained. The secondary crystallization took place so slowly and quietly that the heaps of carbonaceous dust were not disturbed, but merely enclosed by the crystal grains, and their shapes preserved.

The deposition of pyrite took place at still a later time. Migrating solutions brought in ferrous sulphate, which was reduced to sulphide by the carbon near the surface of the normal ooïds, and around the black part of the divided ones. Apparently the rearrangement of the carbon particles in the latter rendered them more readily attacked, for both microscopic examination and the analysis show them to be the higher in limonite, which now takes the place of the pyrite. This last change, which represents the latest chapter in the history of the rock, was evidently brought about by the action of oxygen-bearing rain water.

Ooids exhibiting all stages of these various processes are shown in the figures, examination of which will leave no doubt that this rock, which at first sight appears so remarkable, has had the comparatively simple origin here outlined.

EXPLANATION OF PLATES.

Plate 40.

Fig. 1. A cross section of the oolite rock, natural size. Shows division of ooids into black and white portions, and lens-shaped patch in which many are unchanged, in the left-center. Cat. No. 88448, U.S.N.M.

2. The central portion of the same specimen, enlarged 5 times. Shows coarse crystallization of ooids, variable though usually convex dividing line between black and white portions, nuclei central in unchanged grains, but dropped into black portions in the divided ones.

Plate 41.

All enlarged 40 times.

Fig. 1. Ooid showing nucleus but little displaced from center.

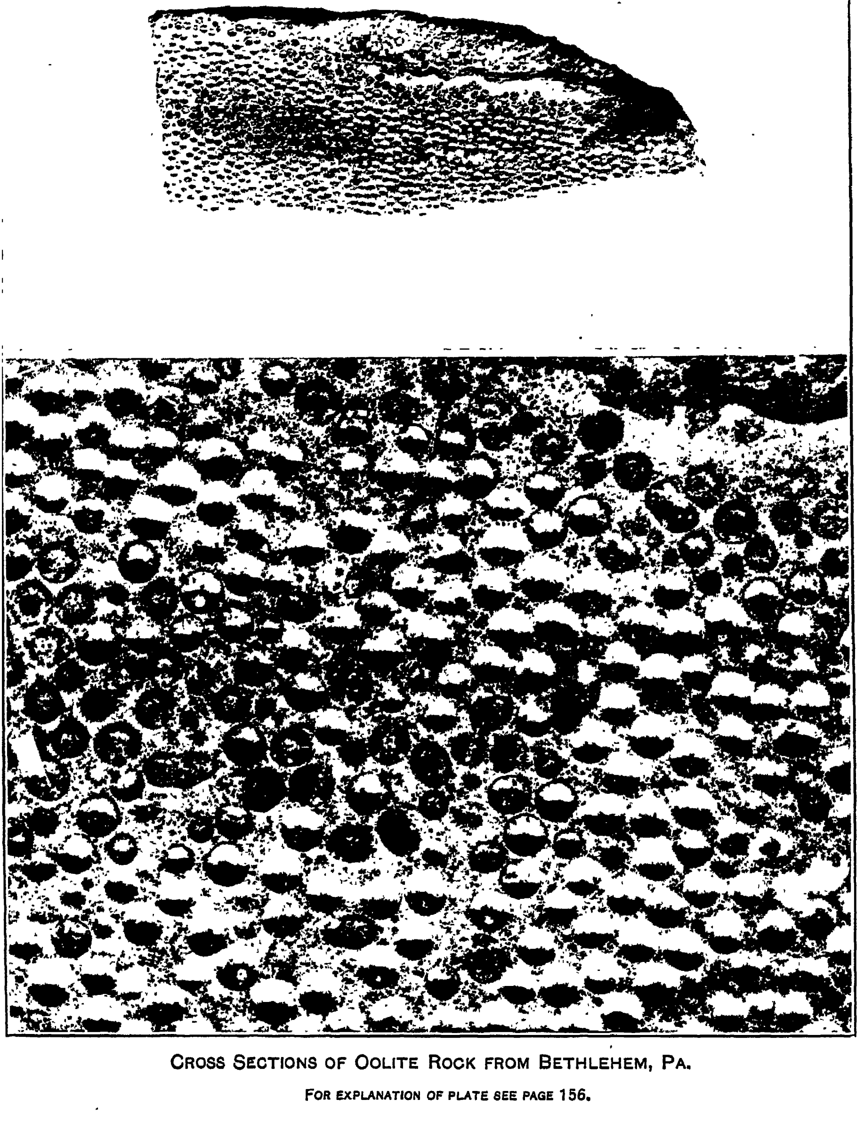
2. Nucleus, retaining several concentric coats, sunk in dark portion of ooid, the dark material being heaped up over it.

3. Nucleus, deprived of concentric coats, sunk in dark portion of ooid with less heaping up of material; specks of limonite surrounding dark portion prominent.

4. Nucleus entirely dissolved away, and line between dark and light portions of ooid straight.

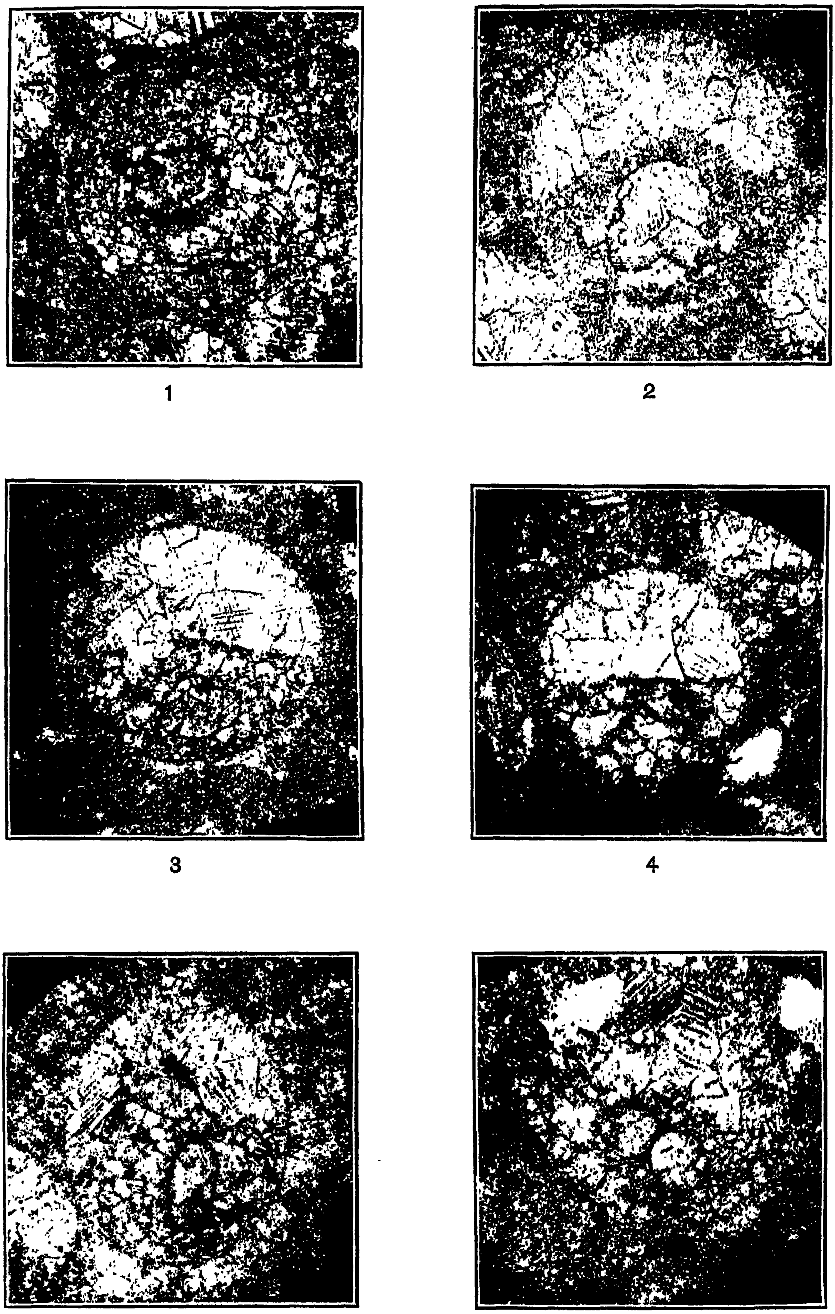
5. An elongated ooid, with its nucleus of corresponding shape; the latter sunk in dark portion, which was, however, too viscous for it to fall flat.

6. An ooid with two nuclei.



CROSS SECTIONS OF OOLITE ROCK FROM BETHLEHEM, PA.

FOR EXPLANATION OF PLATE SEE PAGE 156.



1 2

3 4

5 6

SECTIONS SHOWING STRUCTURAL DETAILS IN OOLITE FROM BETHLEHEM, PA.

FOR EXPLANATION OF PLATE SEE PAGE 156.

ON A COLLECTION OF JAVANESE CRANE-FLIES (TIPULIDAE, DIPTERA) IN THE UNITED STATES NATIONAL MUSEUM.

By Charles Paul Alexander,

Of the Entomological Laboratory of Cornell University, Ithaca, New York.

INTRODUCTION.

The present paper is based on the extensive collections of insects taken on the island of Java in 1909 by Messrs. Owen Bryant and William Palmer. The crane-flies of this collection number about 150 specimens referable to some 60 species.

There has been a great amount of work done upon the crane-fly fauna of India and the East Indies in recent years and this has been accomplished for the greater part by the following workers:

Wiedemann in his Diptera exotica (1821) and Aussereuropäische zweiflügelige Insekten (1828) characterized a number of Javan species. His descriptions are excellent and very few of his species remain unrecognized. Francis Walker described a very considerable number of species, since he had access to the immense collections of the British Museum and William W. Saunders, the latter including most of the material taken by Alfred Russell Wallace in the Malay Archipelago. Doleschall (1856–1858) described a few species from the Dutch East Indies. Van der Wulp up until his death in 1899 published a number of articles dealing with the dipterous fauna of Java; these papers contain splendid descriptions and often beautifully colored figures by the author.

The living workers include Brunetti whose recent volume on the Diptera Nematocera of India (Fauna of British India, 1912) will do much to stimulate the study of this order in that country. Enderlein, who has published one very valuable paper (1912), most of his East Indian material being from Sumatra. Riedel in a short series of articles (Supplementa Entomologica, No. 1, August, 1912; Entomologische Mitteilungen, vol. 2, August, 1913), has worked over Sauter's Formosan collections. Edwards has given some very valuable contributions to our knowledge of the Oriental and African faunas; his most recent paper, a revision of the difficult genus *Styringomyia* (1914) is especially helpful. By far the most important work on the crane-flies of the island under consideration is that of Doctor de Meijere who has published a long series of valuable articles on the Dipterous fauna of Southeast Asia.

GEOGRAPHICAL DISTRIBUTION.

The following notes will serve to give some idea of the geographic and topographic conditions under which the collection was made. It should be noted that the name "Pangranggo" is spelled in various ways. Reclus has it "Panggerango," and Wallace "Pangerango." The form adopted in the present paper is the one appearing on the printed insect labels of the collection.

> *Gedé and Pangranggo.*—The western has a much greater mean elevation than the eastern section of the island, forming a plateau from 2,000 to 3,000 feet high. Here also the mountains are connected by lofty ridges or saddles, the former intervening valleys having been to a great extent filled in by outflows of lavas and showers of ashes and scoriae * * * East of this pass follow the far loftier cones of Gedé or the "Great" (9,800 feet) which gives its name to a whole group, and the neighboring Mandala-Wangi which exceeds it by 200 feet. The Gedé, properly so called, has frequently ejected scoriae and from its bleached crater, about 4,000 feet in circumference, jets of vapor are still emitted; sulphur is also deposited on the encircling walls while copious thermal streams flow from the flanks of the mountain. Gedé is connected by a narrow ridge with another and far larger crater which from the Sala wall on the south to Panggerango on the north side has a circuit of about two and a half miles. It is wooded to the summit, terminating in an inclined terrace whence numerous rivulets rapidly converge in a broad stream which was till recently visited by the rhinoceros. From this terrace, the highest point of observation in west Java, a panoramic view is commanded of both seas, with the intervening hills and plains, forests, villages and surrounding plantations.[1]
>
> *Buitenzorg.*—In 1774, Buitenzorg, that is "Sans Souci," was chosen as a site of an official health resort and this place has by successive enlargements become a vast residence, now usually occupied by the Governor Generals of the Dutch East Indies. Lying 880 feet above the sea on a wooded slope between the Liwong and Dani river valleys, Buitenzorg commands a superb prospect of the surrounding forest-clad gloomy gorges and undulating heights, rising in one direction toward Mount Salak, in another toward Gedé * * * But Buitenzorg is not sufficiently elevated to be regarded as a sanitarium. Hence invalids and convalescents usually prefer the station of Sindang-Laya, which stands at an altitude of 3,560 feet on the northern slope of Gedé near the vast nursery grounds of Tjibodas.[2]

Alfred Russell Wallace, who climbed the mountains of Gedé and Pangranggo in 1861, describes his experiences as follows:

> By far the most interesting incident of my visit to Java was a trip to the summit of Pangerango and Gedeh Mountains, the former an extinct volcanic cone about 10,000 feet high, the latter an active crater on a lower portion of the same mountain range. * * * The first mile was over open country which brought us to the forest that covers the whole mountain from a height of about 5,000 feet. The next mile or two was a tolerably steep ascent through a grand virgin forest, the trees being of great size and the undergrowth consisting of fine herbaceous plants, tree-ferns, and shrubby vegetation. I was struck by the immense number of ferns that grew by the side of the road. Their variety seemed endless and I was continually stopping to admire some new or interesting forms. I could now well understand what I had been told by the gardener, that 300 species had been found on this one mountain. * * * Continuing our ascent, the road became narrow, rugged, and steep, winding zigzag up the cone,

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[1] Elisée Reclus, The Universal Geography, vol. 14, p. 150-153.

[2] Idem, p. 185.

which is covered with irregular masses of rock and overgrown with a dense, luxuriant, but less lofty vegetation. We passed a torrent of water which is not much lower than the boiling point, and has a most singular appearance as it foams over its rugged bed, sending up clouds of steam and often concealed by the overhanging herbage of ferns and lycopodia, which here thrive with more luxuriance than elsewhere.[1]

On Mount Pangerango, between 5,350 feet and the top, 10,000 feet, the number of forest trees is about 350 species on the same area (300 hectares or 3 square kilometers) and about 1,400 species of non-arborescent phanerogams.[2]

ACKNOWLEDGMENTS.

I am indebted to the collectors of the material, Mr. Owen Bryant and Mr. William Palmer. The majority of the specimens, including the holotypes and uniques, are in the United States National Museum, and Mr. Frederick Knab, the custodian of the Diptera, has kindly afforded me every opportunity for studying this material. Most of the remaining insects are in Boston in the private collection of Mr. C. W. Johnson, to whom I am grateful for many kindnesses, both at this time and often in the past.

DESCRIPTION OF SPECIES.

Family TIPULIDAE.

Subfamily LIMNOBINAE.

Tribe LIMNOBINI.

Genus DICRANOMYIA Stephens.

Dicranomyia Stephens, Catalogue of British Insects, vol. 2, 1829, p. 243.

DICRANOMYIA SALTENS Doleschall.

? *Limnobia saltens* Doleschall, Natuurk. Tijdschr. Nederl. Indie, vol. 14, 1857, p. 390, pl. 11, fig. 3.

One male of this species, Buitenzorg, Java; March, 1909 (Bryant and Palmer).

DICRANOMYIA CUNEIFORMIS de Meijere.

Dicranomyia cuneiformis de Meijere, Tijdschr. voor Entom., vol. 54, pp. 23, 24, 1911, pl. 1, fig. 2.

One female from Batavia, Java; April 1, 1909 (Bryant and Palmer).

DICRANOMYIA ALBITARSIS, new species.

Size large (wing of the male over 9 mm.); wings dark, the tip brown; tarsi white.

Male.—Length, 7.4 mm.; wing, 9.5 mm. Rostrum and palpi brownish black. Antennae dark brownish black. Head yellowish brown.

Thoracic dorsum light brown without distinct darker markings, the postnotum indistinctly trivittate with darker. Pleura dull brownish yellow. Halteres brown. Legs, femora brown, somewhat darker at the tip; tibiae brown; fore tarsi with the basal two-thirds of the metatarsus brown, remainder white, hind tarsi entirely white. Wings infumed with darker, the tip brown, a narrow brown seam on *r*, veins dark brown; venation: (see pl. 42, fig. 1), *Sc* ending far beyond the origin of *Rs*, Sc_1, about three times as long as Sc_2, *Rs* about three times as long as the deflection of R_{4+5}.

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[1] A. R. Wallace, The Malay Archipelago, pp. 125–131.

[2] A. R. Wallace, The World of Life, 1911.

Abdominal tergites dark brown with about the apical half of each segment dull yellow, the sternites similar with about the apical two-thirds dull yellow.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude, 4,500 feet (Bryant and Palmer).

Type.—Cat. No. 19007, U.S.N.M.

From the other described species with white tarsi, *D. albitarsis* differs as follows: *D. saltens* Doleschall and *cuneiformis* de Meijere have subcosta short, ending before the origin of the radial sector. *D. longivena* Edwards [1] has the subcosta long but is a much smaller insect (wing 5 mm. instead of 9 mm.). *D. kobusi* de Meijere [2] has the tibiae white with black rings, the radial sector short, oblique, cell *1st* M_2 of the wings lacking, etc. *D. novaeguineae* de Meijere[3] is larger, the tibiæ paler, the venation quite different in the very short subcosta, the shorter radial sector and the position of cell *1st* M_2.

DICRANOMYIA ATRESCENS, new species.

Body-coloration dark slate-gray; wings subhyaline with the stigma brown.

Male.—Length, 6.3 mm.; wing, 7.2 mm. Head dark brownish black, the mouth parts injured.

Color of the thorax dark slate-gray with a sparse brown bloom. Halteres brownish black. Legs dark brown, the femora a little brighter than the other segments. Wings subhyaline, stigma rounded, brown, the margins not clearly defined; a brownish mark at the origin of *Rs;* venation: *Sc* ending opposite the origin of *Rs*.

Abdomen concolorous with the thorax; the pleurites of the hypopygium small, cylindrical; the ventral lobe large, almost globular, its inner margin produced entad into a sharp conical point that is fringed with long hairs along the caudal margin; the lobe itself is provided with scattered hairs and a dense short pubescence.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude, 8,000 feet (Bryant and Palmer).

Type.—Cat. No. 19008, U.S.N.M.

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[1] Ann. Mag. Nat. Hist., ser. 8, vol. 8, 1911, p. 58; as *Thrypticomyia.*

[2] Bijd. tot de Dierk., vol. 17, 1904, p. 91, pl. 8, figs. 5, 6, Tijd. voor Entom., vol. 56, 1913, p. 343, pl. 16, fig. 8.

[3] Tijd voor Entom., vol. 58, 1915, p. 101, pl. 1, fig. 7.

This insect is readily separated from the described species of the genus by its dark brownish black coloration and the peculiar shape of the ventral hypopygial lobe. The mouth parts are injured in my specimen and there is a possibility that it should more properly be referred to *Geranomyia.*

DICRANOMYIA ERYTHRINA, new species.

Size large (wing of the male over 10 mm.); thorax reddish brown; wing with *Sc* very long.

Male.—Length, 9 mm.; wing, 11.6 mm. Rostrum short, light brown, the palpi dark brown. Head gray.

Thorax reddish brown, the dorsum scarcely darker. Halteres rather long, light brown; the knob dark. Legs light brown, the tibiae and tarsi darker. Wings with a faint yellowish tinge, stigma indistinct, brownish, veins brown; venation: (see pl. 42, fig. 2), *Sc* long ending just before the fork of *Rs*, Sc_1, about three times as long as Sc_2, *Rs* about three times as long as the deflection of R_{4+5}.

Abdomen reddish brown, the apical three or four segments much darker brown.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude, 4,500 feet (Bryant and Palmer).

Type.—Cat. No. 19009, U.S.N.M.

This species agrees closest with *D. nongkodjadjarensis* de Meijere[1] but is readily separated by its much larger size (wing, 10 mm.; in the other species, 7 mm.).

DICRANOMYIA EXCELSA, new species.

Head grayish; thorax reddish, the dorsum a little darker; wings with the stigma distinct; abdomen brown.

Male.—Length, 7.6 mm.; wing, 9 mm.

Female.—Length, 8 mm.; wing, 8.7 mm. Rostrum and palpi black. Antennae brown, the segments of the flagellum dark brown with a fine silky pubescence. Head dark slaty gray.

Thoracic dorsum shining dark brown, the pleura yellowish black. Halteres light yellow at the base, remainder dark brown. Legs, coxae and trochanters yellowish brown, remainder of the legs brown, the femora paler at the base. Wings hyaline, stigma oval, brown; narrow seams of brown on the cross-veins and the deflections of veins; veins brown; venation: (see pl. 42, fig. 3), *Sc* ending about midlength of *Rs*, Sc_1 twice as long as or as long as Sc_2.

Abdomen with the tip of segment two yellowish, remainder of the abdomen dark brown.

Habitat.—Java.

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[1] Tijd. voor Entom., vol. 56, 1913, pp. 341, 342, pl. 16, fig. 7.

Holotype.—Male; Pangranggo, Java; altitude 9,000 feet (Bryant and Palmer).

Allotype.—Female; Tjibodas, Mount Gedé, Java; altitude 8,000 feet.

Paratypes.—Two males, with the allotype; altitude 8,000–9,000 feet, female, with the allotype; altitude 8,000 feet.

Type.—Cat. No. 19010, U.S.N.M.

Allied to *D. alta* de Meijere[1] but the antennae are shorter, the thoracic dorsum shining, not dull, wings not suffused with brown and the size larger (wing, over 8 mm.; in *alta* 6 mm.).

DICRANOMYIA SIMPLISSIMA, new species.

Media with but one free branch attaining the margin; thoracic dorsum shiny black.

Female.—Length, 5 mm.; wing, 6.3 mm. Rostrum brownish yellow, palpi brownish black. Antennae brownish black. Head dark brown, dusted with gray, provided with numerous black hairs.

Pronotum brownish yellow. Mesonotal praescutum and the lobes of the scutum shiny black, remainder of the notum brownish. Pleura bright brownish yellow. Halteres brown. Legs, coxae, trochanters and femora at its base, bright yellow, remainder of the legs dark brown. Wings almost hyaline, stigma rather indistinct, brown, the veins brown; venation: (see pl. 42, fig. 4), *Sc* very short, ending far before the origin of *Rs; Rs* short, arcuated, a little more than half as long as the deflection of R_{4+5}; vein *M* simple, there being no cell *1st* M_2 and M_3 fused with Cu_1 throughout; basal deflection of Cu_1 at the fork of *M*.

Abdomen dark brown, sternites and ovipositor yellowish.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude 9,000 feet (Bryant and Palmer).

Type.—Cat. No. 19011, U.S.N.M.

There are but four species of this genus known that have the upper branch of media unforked. These are *D. whartoni* Needham (Michigan)[2] which has a long radial sector. *D. tenella* de Meijere (Java)[3] has a short sector, the thoracic dorsum shining yellow and is much smaller (length of the wing 4 mm.). The only other species is *D. carneotincta*, new species, described below.

DICRANOMYIA CARNEOTINCTA, new species.

Media with but one free branch attaining the margin; thoracic dorsum reddish yellow.

Male.—Length, 3mm.; wing, 4.3 mm. Rostrum and palpi reddish brown, the latter rather darker colored. Antennae short, first

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[1] Tijd. voor Entom., vol. 56, 1913, p. 341, pl. 16, fig. 6.

[2] 23rd Report of the New York State Entomologist, 1907, pp. 211, 212, pl. 27, fig. 5.

[3] Tijdschr. voor Entom., vol. 56, 1911, p. 27, pl. 1, figs. 11-13.

segment reddish yellow, flagellum brownish black. Head with the front whitish, remainder dark brown.

Thoracic dorsum reddish yellow, pleura dull yellow. Halteres brown. Legs, coxae, trochanters and the base of the femora light yellow, the latter darkening into brown, the tip quite dark, tibiae and tarsi brownish black. Wings hyaline, stigma rounded, indistinct, veins dark; venation: (see pl. 42, fig. 5), *Sc* short ending far before the origin of *Rs*, this distance longer than the length of the radial sector; the radial sector shorter than the deflection of R_{4+5}.

Abdomen reddish yellow.

Habitat.—Malay Peninsula.

Holotype.—Singapore, Malay Peninsula; 1909 (Bryant and Palmer).

Type.—Cat. No. 19012, U.S.N.M.

This species differs from *D. tenella* de Meijere, the only species that is at all close to it, in having a much shorter subcosta and a longer radial sector. In *tenella*, *Sc* ends but a short distance before the origin of *Rs* whereas in *carneotincta* this distance is longer than the length of the sector.

Genus GERANOMYIA Haliday.

Geranomyia HALIDAY, Entom. Magaz., vol. 1, 1833, p. 154.

GERANOMYIA NITIDA de Meijere.

Geranomyia nitida de MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 28, 29.

One female from Batavia, Java; April 1, 1909 (Bryant and Palmer). The wing is shown on plate 42, figure 6.

GERANOMYIA LINEARIS, new species.

Rostrum brownish black; mesonotum dark brown, the humeral angles yellow; pleura yellowish; wings tipped with brown.

Male.—Length, 5.8 mm.; wing, 6.2 mm.; rostrum, 2.6 mm. Rostrum elongated, much longer than the head and thorax combined, dark brownish black. Palpi biarticulate, dark brownish black. Head dark gray.

Thoracic dorsum very dark brown, the humeral angles paler, yellowish. Pleura dull yellow. Halteres brown. Legs, coxae and trochanters yellowish, base of the femora yellowish, remainder of the legs brownish black. Wings suffused with brown, the stigma still darker, brownish; venation: (see pl. 42, fig. 7), *Sc* long, ending just before the fork of *Rs*; Sc_2 near the tip of Sc_1, the two forks of *Sc* subequal in length; *Rs* twice as long as the deflection of R_{4+5}.

Abdomen dark brown, the ventral lobes of the hypopygium very long and slender, the tips more pointed, the lobe nearly three times as long as the pleura itself.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude 4,500 feet (Bryant and Palmer).

Type.—Cat. No. 19013, U.S.N.M.

In de Meijeres key to the Javan species of this genus,[1] this runs to *G. nitida* de Meijere which is a smaller insect with the pale margin to the thorax broader, the wings not so dark, etc.

GERANOMYIA JAVANICA, new species.

Thoracic dorsum light gray narrowly lined with black; wings spotted with brown.

Female.—Length, 6.8 mm.; wing, 7 mm.; rostrum, 3.5 mm. Rostrum and palpi dark brownish black. Antennae and head dark brownish black.

Thoracic dorsum with the praescutum light gray narrowly lined with black; a broader median stripe including the dorsum of the pronotum and continuing to the suture; a much narrower, more delicate stripe on either side of this; lateral margin of the sclerite black; scutum with the lobes dark; scutellum gray, the caudal margin blackish. Pleura bluish gray, a yellow ventral stripe including the fore and middle coxae. Halteres brown. Legs, fore and middle coxae yellow; femora pale brown at the base, tip dark brown; tibiae and tarsi dark brown. Wings with a slight suffusion; membrane with brown blotches, about seven being on the costa, the third at the origin of *Rs*, the fourth at the tip of *Sc*, the fifth at the tip of R_1; brown marks along the cross-veins and deflections of veins; venation: (see pl. 42, fig. 8), *Sc* long, ending just beyond mid-length of *Rs*; *Rs* between two and three times as long as the deflection of R_{4+5}.

Abdomen dark brownish black, ovipositor light brown.

Habitat.—Java.

Holotype.—Batavia, Java; April 1, 1909 (Bryant and Palmer).

Type.—Cat. No. 19014, U.S.N.M.

This species is allied to *G. decemguttata* de Meijere[2] but the wing-pattern is very much heavier and the thoracic pattern entirely different. It also resembles *G. pulchripennis* Brunetti[3] but the thorax is grayish, not brownish yellow.

Genus RHIPIDIA Meigen.

Subgenus RHIPIDIA Meigen.

Rhipidia MEIGEN, Syst. Beschr., vol. 1, 1818, p. 153.

RHIPIDIA (RHIPIDIA) JAVANENSIS de Meijere.

Rhipidia javanensis de MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 31, 32.

Tjibodas, Mount Gedé, Java; altitude 4,500 feet, a male; altitude 8,000 feet, a male; altitude 9,000 feet, a male (Bryant and Palmer).

The wing has never been figured; it is shown on plate 42, fig. 9.

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[1] Tijdschr. voor Entom., vol 54, 1911, p. 31.

[2] Idem, vol. 56, 1913, pp. 345, 346, pl. 16, fig. 11.

[3] Fauna of British India, Diptera Nematocera, 1912, pp. 393, 394, pl. 8, fig. 1.

Genus GONIODINEURA van der Wulp.

Goniodineura van der WULP, Tijdschr. voor Entom., vol. 38, 1895, p. 37.

GONIODINEURA NIGRICEPS van der Wulp.

Goniodineura nigriceps van der WULP, Tidschr. voor Entom., vol. 38, 1895, p. 38, pl. 2, figs. 3–5.

One female of this interesting crane-fly from Buitenzorg, Java; March, 1909. (Bryant and Palmer.) The venation is shown in plate 42, fig. 10. The specimen measures 6.8 mm. in length with the wing 7.2 mm.

Genus LIMNOBIA Meigen.

Limnobia MEIGEN, Syst. Beschr., vol. 1, 1818, p. 116.

LIMNOBIA ANNULIFEMUR de Meijere.

Limnobia annulifemur de MEIJERE, Tijdschr. voor Entom., vol. 56, 1913, pp. 344, 345, pl. 17, fig. 12.

One female of this beautiful *Limnobia* from Tjibodas, Mount Gedé, Java, at an altitude of 8,000 feet (Bryant and Palmer).

Genus LIBNOTES Westwood.

Libnotes WESTWOOD, Trans. Entom. Soc. London, 1876, p. 505.

LIBNOTES STRIGIVENA Walker.

Limnobia strigivena WALKER, Proc. Linn. Soc. London, vol. 5, 1861, p. 229.
Libnotes strigivena OSTEN SACKEN, Berl. Ent. Zeitschr., vol. 31, 1887, p. 182.
Libnotes strigivena SKUSE, Proc. Linn. Soc. N. S. Wales, ser. 2, vol. 4, 1889, p. 786, pl. 21, fig. 8.
Libnotes strigivena de MEIJERE, Tijd. voor Entom., vol. 54, 1911, p. 35.
Libnotes strigivena de MEIJERE, Tijd. voor Entom., vol. 56, 1913, p. 346.

One male from Mount Salak, Java, May 15, 1909 (Bryant and Palmer). It shows the following measurements: Length, 10.3 mm; wing, 15.3 mm.

LIBNOTES, sp.

A large species that comes close to *poeciloptera* Osten Sacken[1] but the character of R_1 beyond the cross-vein *r* is different from that described for this species. The material shows the following measurements: Male, length, 11–13 mm.; wing, 14–18 mm. Female, length, 16 mm.; wing, 18.5 mm. Three male and one female from Tjibodas, Mount Gedé, Java, August 26, 1909, at an altitude of 8,000 feet, collected by Bryant and Palmer. The wing is shown on plate 43, fig. 11.

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[1] Ann. Mus. Civ. Genova, vol. 16, 1881, p. 403.

LIBNOTES MONTIVAGANS, new species.

Thorax reddish, with a dark dorsal line; wings hyaline, sparsely spotted with brown.

Male.—Length, 5.8 mm.; wing, 7.4 mm.

Female.—Length, 6 mm.; wing, 7.4 mm. Rostrum, palpi, and antennae dark brown. Head dark brownish gray.

Thoracic dorsum brownish yellow, with a dark brown median stripe, which is narrowest in front, broader behind at the suture; lobes of the scutum dark brown. Pleura brownish yellow, brightest on the sternal sclerites. Halteres brown. Legs, coxae and trochanters dull yellow, remainder of the legs dark brown. Wings nearly hyaline, with brown markings as follows: a large stigmal spot, a smaller mark at origin of *Rs*, veins comprising the cord and outer deflection of cell *1st* M_2 broadly seamed; tip of wing slightly infumed; veins brown; venation: (see pl. 43, fig. 12), Sc_2 at the tip of Sc_1 and of equal length; *Rs* about five times as long as the deflection of R_{4+5}; *Rs* long, arcuated at its base.

Abdomen dark brown above, sternites indistinctly dull yellow.

Habitat.—Java.

Holotype.—Male, Tjibodas, Mount Gedé, Java; altitude, 8,000 feet (Bryant and Palmer).

Allotype.—Female, topotypic.

Type.—Cat. No. 19015, U.S.N.M.

This species belongs to the group containing species like *forcipata* de Meijere, *familiaris* Osten Sacken, etc., forms that run very close to certain species of *Dicranomyia*.

L. familiaris Osten Sacken [1] has the radial sector almost straight, about twice the length of the deflection of R_{4+5}; cell *1st* M_2 long, as long as Cu_1 beyond the end of cell *1st* M_2; cross-veins seamed with brown. *L. forcipata* de Meijere [2] has the basal deflection of R_{4+5} much longer than the cross-vein *r–m;* basal deflection of Cu_1 near the fork of *M;* dark markings on the wings sparse, etc.

LIBNOTES NERVOSA de Meijere.

Libnotes nervosa de MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 36, 37, pl. 2, fig. 21.

One male from Buitenzorg, Java, April 9, 1909, collected by Bryant and Palmer.

LIBNOTES NIGRICORNIS, new species.

Thorax yellowish brown; wings nearly hyaline.

Male.—Length, 6.6 mm.; wing, 7.4 mm.

Female.—Length, 6.5 mm.; wing, 7.5 mm. Rostrum, palpi, and antennae brownish black. Head brownish gray.

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[1] Berlin, Entom. Zeitschr., vol. 26, 1882, p. 89.

[2] Tijdschr. voor Entom., vol. 54, 1911, pp. 38, 39, pl. 2, fig. 23.

Thorax yellowish brown, the dorsum indistinctly darker; scutellum darker brown. Halteres rather short, knob brown, stem yellow. Legs, coxae, and trochanters dull yellow, remainder of the legs brown. Wings nearly hyaline, veins brown; venation: (see pl. 43, fig. 13), *Sc* long, extending far beyond the fork of *Rs*; Sc_2 near the tip of Sc_1. Abdomen dark brown.

Habitat.—Java.

Holotype.—Male, Tjibodas, Mount Gedé, Java; altitude, 4,500 feet (Bryant and Palmer).

Allotype.—Female, topotypic.

Type.—Cat. No. 19016, U.S.N.M.

L. nigricornis is allied to *L. forcipata* de Meijere, but the antennae are dark throughout and the details of venation are different.

Tribe ANTOCHINI.

Genus PARATROPEZA Schiner.

Paratropeza SCHINER, Verh. zool.-bot. Ges. Wien, vol. 16, 1866, p. 932.

PARATROPEZA ORNATIPENNIS de Meijere.

Gnophomyia ornatipennis de MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 47, 48, pl. 3, fig. 34.

Four males, Tjibodas, Mount Gedé, Java, altitude 4,500 feet (Bryant and Palmer). This is the first species of the genus to be found in the Old World, the five species hitherto described being confined to the Neotropical region. It was described as a *Gnophomyia* but the whole habitus of the insect is Antochine and I believe that the insect should be referred to *Paratropeza*. The wing is shown on plate 43, fig. 14.

Genus RHAMPHIDIA Meigen.

Subgenus RHAMPHIDIA Meigen.

Rhamphidia MEIGEN, System. Beschr., vol. 6, 1830, p. 281.

RHAMPHIDIA (RHAMPHIDIA) APICALIS, new species.

Body-coloration brownish; wings hyaline tipped with brown.

Male.—Length, 5–5.8 mm.; wing, 5.7–6.3 mm.

Female.—Length about 7.4 mm; wing, 7 mm. Rostrum moderately elongated, much longer than the head, dark brownish black, the palpi dark brown. Antennae dark brown, rather elongated, in the male if bent backward, extending to the base of the abdomen; shorter in the female, extending about to the wing-root. Head dark brown.

Thoracic coloration varying from light to rather dark brown without distinct stripes, the pleura brighter colored, more yellowish. Halteres light brown. Legs, coxae brownish yellow; trochanters light brown; femora light brown basally passing into dark brown beyond the base; tibiae and tarsi dark brown. Wings hyaline, the tip narrowly brown; stigma distinct, oval, light brown; veins dark brown; venation, see plate 43, fig. 15.

Abdominal tergites dark brown, sternites light brown; valves of the female ovipositor very long and slender.

Habitat.—Java.

Holotype.—Male, Tjibodas, Mount Gedé, Java; altitude 4,500 feet (Bryant and Palmer).

Allotype.—Female, topotypic.

Paratypes.—One female, topotypic; 1 male, topotypic, altitude 8,000 feet.

Type.—Cat. No. 19017, U.S.N.M.

From *R. kambangani* de Meijere,[1] from Java, *R. ferruginosa* Brunetti,[2] *R. unicolor* Brunetti,[3] and *R. inconspicua* Brunetti;[4] the three last-named species from British India, this new form differs in the dark apex to the wings.

EURHAMPHIDIA, new subgenus.

Rostrum elongated as in *Rhamphidia* Meigen; differs from *Rhamphidia*, s. s., in the fusion of R_{2+3} with R_{4+5} for a considerable distance beyond the radio-median cross-vein. This character occurs in no other member of this tribe of crane-flies with the exception of the genus *Rhampholimnobia*, new genus, described below.

Type.—*Rhamphidia niveitarsis* Skuse.

RHAMPHIDIA (EURHAMPHIDIA) NIVEITARSIS Skuse.

Rhamphidia niveitarsis SKUSE, Proc. Linn. Soc. N. S. Wales, ser. 2, vol. 4, 1889, pp. 791, 792.

Wings subhyaline, stigma oval, brown, veins brown; body-coloration light yellowish brown; abdomen with the segments tipped with yellowish; legs with the knees and the tarsi white.

Male.—Length, 5.6–6.6 mm.; wing, 6.4–7.1 mm.

Female.—Length, 6.8–7 mm.; wing, 7–7.2 mm. Rostrum rather elongated, longer than the head, brown, the palpi dark brown. Antennae short, if bent backward, not extending to the wing-root, the flagellar segments very short with numerous long pale hairs. Head brownish gray.

Thorax dull light yellow, the dorsum with a narrow dark brown median line; lobes of the scutum brown; postnotum brownish; in some specimens the thorax is darker, light brown, even the pleura being of this color. Halteres brown, paler at the base. Legs, coxae and trochanters dull brownish yellow; femora light yellowish brown, the tip broadly white; tibiae with the base white, this space being a little shorter than the tip of the femora, remainder of the tibiae brown except the apical fourth which is white; tarsi white. Wings subhyaline, stigma oval, brown, veins brown; venation: (see pl. 43, fig. 16), the fusion of R_{2+3} and R_{4+5} beyond *r–m* is longer than this cross-vein.

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[1] Tijd. voor Ent., vol. 56, 1913, pp. 346, 347, pl. 17, fig. 13.

[2] Fauna of British India, Diptera Nematocera, 1912, p. 418, pl. 8, fig. 8; pl. 11, fig. 11.

[3] Idem, p. 419.

[4] Idem, pp. 419, 420.

Abdominal tergites 3 to 7 dark brown on the basal two-thirds, yellowish on the apical third; sternites more yellowish; hypopygium dark brown.

Habitat.—New South Wales; Java.

Twelve specimens in the collection, as follows: Tjibodas, Mount Gedé, Java; 3 males, 2 females, at 9,000 feet; 1 male at 8,000 feet. (Bryant and Palmer). Pangranggo, Java; 4 males, 2 females, 9,000 feet. (Bryant and Palmer).

Skuse described this species from New South Wales and it has not been found since his time apparently.

Genus RHAMPHOLIMNOBIA, new genus.

Antennae 15-segmented, the first segment elongated. Front between the eyes narrowed (in the female), on the lower surface of the head the eyes are contiguous. Rostrum very long, powerful, compressed, the tip apparantly broken in the unique type, length of the rostrum about equal to the head and thorax together, viewed from the side, the rostrum at the base is one-half as deep as the head, gradually narrowed toward the tip; viewed from above very narrow. Neck long and narrow. Venation: *Rs* elongate, gently arcuated at the base, R_{2+3} and R_{4+5} fused for a slight distance beyond the cross-vein *r–m*; R_{2+3} short, arcuated; cross-vein *r–m* long, prominent; basal deflection of Cu_1 before the fork of *M*.

Type.—*Rhampholimnobia reticularis*, new species.

This genus differs from *Elephantomyia* in the contiguity of the eyes beneath, the very powerful compressed rostrum, the venation as regards the basal fusion of R_{2+3} and R_{4+5}, the position of the basal deflection of Cu_1, etc.

RHAMPHOLIMNOBIA RETICULARIS, new species.

Coloration brown and yellow; wings hyaline, reticulated with brown.

Female.—Length, 8.2 mm.; wing, 6.4 mm.; rostrum (tip broken?), 1.8 mm. Rostrum dark brown. Antennae with the first segment gray, the second dark brownish black, third segment light yellow, remainder of the antennae light brown. Head light gray with several large clove-brown blotches on the middle of the vertex and occiput.

Cervical sclerites and pronotum brown; suture between the pro- and meso-nota yellow. Mesonotal præscutum light reddish brown with four darker brown lines; the middle pair longest, broader and more distinct behind; lateral stripes lying behind the pseudosutural foveae; region around the pseudosuture grayish yellow; scutum light brown, the lobes dark brown; scutellum and postnotum brown. Pleura dull gray, a dark brown blotch on the dorsal portions of the mesepisterna surrounding the anterior spiracle. Halteres light yellow. Legs, coxae dark brown; trochanters dull brownish yellow; remainder of the legs broken. Wings, costal cell and vein light yellow; remainder of the wing hyaline, veins brown; the membrane with numerous brown marks crossing the individual cells giving to the wing a reticulated appearance; venation: (see pl. 43, fig. 17), *Sc* rather long ending before the cross-vein *r–m*; R_{2+3} and R_{4+5} fused for a short distance beyond cross-vein *r–m*; R_{2+3} short, arcuated, tending to be oblique; basal deflection of Cu_1 before the fork of *M*.

Abdomen dark brown, valves of the ovipositor dull yellow.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java: altitude 4,500 feet. (Bryant and Palmer.)

Type.—Cat. No. 19018, U.S.N.M.

Genus ORIMARGA Osten Sacken.

Orimarga OSTEN SACKEN, Mon. Dipt. N. Amer., pt. 4, 1869, p. 120.

ORIMARGA, sp.

One injured specimen fom Buitenzorg, Java, March, 1909; this may be *Orimarga borneensis* Brunetti,[1] as it agrees better with this insect than it does with *O. javana* de Meijere.[2]

Genus STYRINGOMYIA Loew.

Styringomyia LOEW, Dipterol.-Beitrag., vol. 1, 1845, p. 6.

STYRINGOMYIA, sp.

A male and a female from Buitenzorg, Java, March, 1909 (Bryant and Palmer). A male from Pelaboean Ratoe, Java, October, 1909 (Bryant and Palmer).

This is probably *S. jacobsoni* Edwards,[3] but the genitalia are not as described and figured by the author. The elongate hair on the dorsal pleural appendage is much longer, the ventral pleural appendage is differently shaped, the spine on the tip of the pleura is longer and sharper, and the median appendage to the ninth sternite is not expanded, as shown in figure 35 of the article.

Whether or not all of the numerous species of this genus are valid is a question that can not be answered at this time. Mr. Edwards must be given all credit for giving to the world such a splendid revision of a very difficult group of insects.

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[1] Records of the Indian Museum, vol. 6, 1911, p. 280.

[2] Tijdschr. voor Entom., vol. 56, 1913, p. 348, pl. 17, fig. 15.

[3] Trans. Ent. Soc. Lond., 1914, pp. 220, 221, figs. 6, 7, 34, 35, and 73.

Genus ANTOCHA Osten Sacken.

Antocha Osten Sacken, Proc. Acad. Nat. Sci. Phila., 1859, p. 219.

ANTOCHA JAVANENSIS, new species.

Thorax grayish brown without distinct darker markings; wings whitish, stigma distinct; basal deflection of Cu_1 before the fork of *M*.

Female.—Length, 4.2 mm.; wing, 4.8 mm. Rostrum and palpi dark brown. Antennae brown. Head grayish brown.

Thoracic dorsum light grayish brown without distinct markings. Pleura grayish. Halteres yellow. Legs, coxae, and trochanters dull yellow; femora, tibiae, and tarsi light brown. Wings whitish, the stigma distinct, pale brown; veins brown. Venation: (see pl. 43, fig. 18), cross-vein *r* indistinct, basal deflection of Cu_1 before the fork of *M*.

Abdomen light brown.

Habitat.—Java.

Holotype.—Pelaboean Ratoe, Java; October 19, 1909 (Bryant and Palmer).

Type.—Cat. No. 19019, U.S.N.M.

This species agrees closest with *Antocha indica* Brunetti,[1] but the color of the thorax is quite different, the wings whitish with the stigma distinct, etc.

Genus ATARBA Osten Sacken.

Atarba Osten Sacken, Mon. Dipt. N. Amer., pt. 4, 1869, 127.

ATARBA JAVANICA, new species.

Color of the body and wings yellowish; subcosta extending beyond the middle of the radial sector.

Female.—Length, 6.8 mm.; wing, 7.2 mm. Rostrum, moderate in length, shorter than the head, dull yellow; the palpi brown. Antennae with the basal segments brownish yellow; the flagellum broken. Head, yellowish brown.

Thoracic dorsum dull yellow without well-defined darker markings. Pleura dull brownish yellow with an indistinct brown stripe; a slight grayish pruinosity above the middle coxae. Halteres dull yellow. Legs, coxae, and trochanters dull yellow; femora yellow, very narrowly tipped with dark brown; base of the tibiae very narrowly brown, remainder of the tibiae and tarsi dull yellow; the apical tarsal segments brown. Wings light yellow, the veins yellow. Venation: (see pl. 43, fig. 19), *Sc* long, ending beyond the middle of the radial sector; R_{2+3} rather short and oblique, the space on the wing margin between R_1 and R_{2+3} very much shorter than that between R_{2+3} and R_{4+5}; basal deflection of Cu_1 under the basal third of cell *1st* M_2.

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[1] Fauna of British India, Diptera Nematocera, 1912, pp. 426, 427, pl. 8, fig. 12.

Abdominal segments dull yellow; the apical two-thirds of each segment dark brown.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude, 8,000 feet. (Bryant and Palmer.)

Type.—Cat. No. 19020, U.S.N.M.

Of the species of crane-flies described as *Atarbae* from the Oriental and African regions, *Atarba flava* Brunetti[1] is the only one that is congeneric with the type, *picticornis* Osten Sacken of the United States. The other species are almost without exception members of the subgenus *Leiponeura* of the genus *Gonomyia* Meigen. The following may be mentioned:

Atarba lamellaris Speiser,[2] Africa.
Atarba nebulosa de Meijere,[3] Java.
Atarba pilifera de Meijere,[4] Java.
Atarba diffusa de Meijere,[5] Java.

Atarba javanica differs from *A. flava* as follows:

1. *Sc* short, ending just beyond the origin of *Rs;* R_{2+3} long, the distance on the wing-margin between R_1 and R_{2+3} at least as long as that between R_{2+3} and R_{4+5}. (India) .... *flava* Brunetti.
Sc longer, ending beyond the middle of *Rs;* R_{2+3} short, oblique, the distance on the wing-margin between R_1 and R_{2+3} much less than half that between R_{2+3} and R_{4+5}. (Java) .... *javanica*, new species.

Tribe ERIOPTERINI.

Genus ERIOPTERA Meigen.

Subgenus ERIOPTERA Meigen.

Erioptera MEIGEN, Illiger's Magazine, vol. 11, 1803, p. 262.

ERIOPTERA (ERIOPTERA) JAVANENSIS de Meijere.

Erioptera javanensis DE MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 45, 46, pl. 3, fig. 28.

One male from Pelaboean Ratoe, Java, October 16, 1909; one female, Buitenzorg, Java, March, 1909; collected by Bryant and Palmer.

Subgenus ACYPHONA Osten Sacken.

Acyphona OSTEN SACKEN, Mon. Dipt. N. Amer., vol. 4, 1869, p. 151.

ERIOPTERA (ACYPHONA) FENESTRATA de Meijere.

Acyphona fenestrata DE MEIJERE, Tijdschr. voor Entom., vol. 56, 1913, pp. 352, 353, pl. 17, fig. 19.

One female from Tjibodas, Mount Gedé, Java; altitude, 8,000 feet; collected by Bryant and Palmer.

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[1] Fauna of British India, Diptera Nematocera, 1912, pp. 435, 436, pl. 8, fig. 15.

[2] Beiträge zur Dipteren fauna von Kamerun, Deutsch. Ent. Zeitschr., 1913, p. 136, fig. 5, 6.

[3] Studien über südostasiatische Dipteren, V, Tijd. voor Ent., vol. 54, 1911, p. 42, pl. 2, fig. 25.

[4] Idem, p. 43, pl. 2, fig. 26.

[5] Idem, pp. 43, 44.

Genus GONOMYIA Meigen.

Subgenus GONOMYIA Meigen.

Gonomyia MEIGEN, Syst. Beschr., vol. 1, 1818, p. 146.

GONOMYIA (GONOMYIA) BRYANTI, new species.

Cell *1st* M^2=closed; wings subhyaline.

Male.—Length, 4.4 mm.; wing, 6 mm. Rostrum, palpi, and antennae brownish black. Head gray.

Pronotum light yellow. Mesonotal praescutum and the lobes of the scutum dark brown; median line of the scutum and the scutellum light brown; postnotum dark brown. Pleura dull yellow. Halteres brown, the extreme base paler. Legs with the coxae and trochanters brown, remainder of the legs dark brown, unmarked. Wings hyaline or nearly so, stigma indistinct, veins brown; venation; (see pl. 44, fig. 20), *Sc* ending just beyond the origin of *Rs; Rs* long, gently arcuated; R_{2+3} long, about two-thirds the length of the sector; basal deflection of R_{4+5} punctiform so that R_{4+5} is in a line with *Rs.*

Hypopygial pleurites moderately long, the dorsal appendage short, fleshy, pale; ventral appendage elongate, chitinized, provided with numerous long hairs and caruncles, its tip rather truncated; from the ventral inner side of the pleurite near its tip arises a small chitinized appendage shaped as in figure 49. (See pl. 47, figs. 48, 49.)

Abdomen dark brown; hypopygium yellow, its appendages black.

Habitat.—Java.

Holotype.—Male, Tjibodas, Mount Gedé, Java; altitude, 8,000 feet; August 26, 1909 (Bryant and Palmer).

Paratype.—Sex ?, topotypic.

Type.—Cat. No. 19021, U.S.N.M.

Allied to *G. affinis* Brunetti[1] in the venation but larger, the thoracic pattern different, legs much darker, etc.

Genus MONGOMA Westwood.

Mongoma WESTWOOD, Trans. Entom. Soc. London, 1881, p. 364.

MONGOMA CARINICEPS Enderlein.

Mongoma cariniceps ENDERLEIN, Zool. Jahrb., vol. 32, 1912, pp. 60, 61, fig. L 1.

A male and a female from Mount Salak, Java, May 15, 1909, collected by Bryant and Palmer. The female sex has never been described and I make this specimen the allotype. The coloration is quite as in the male, but the size is smaller (length, 11.5 mm.; wing, 10.3 mm.).

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[1] Fauna of British India, Diptera Nematocera, 1912, pp. 472, 473, pl. 9, fig. 7.

MONGOMA SAUCIA, new species.

Allied to *trentepohlii* Wiedemann; a brown crossband along the cord.

Female.—Length, about 4.5 mm.; wing, 4.8 mm. Rostrum and palpi dark brown. Antennae long, if bent backward extending to just before the wing-root (in the female sex). Head dark.

Thoracic dorsum light brown without distinct darker stripes. Pleura rather darker brown. Halteres dull light yellow. Legs, coxae and trochanters dull brownish yellow, remainder of the legs light yellowish throughout. Wings hyaline or nearly so with pale brown markings as follows: tip of the wing brown except a large clear rounded spot in cell R_2; a broken crossband at the cord; a brown seam along *Cu;* venation (see pl. 44, fig. 21).

Abdomen dark brown.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude, 7,800 feet (Bryant and Palmer).

Type.—Cat. No. 19022, U.S.N.M.

This species belongs to the *trentepohlii* group and is closest to *trentepohlii* Wiedemann[1] but has a brown crossband at the cord.

Genus CONOSIA van der Wulp.

Conosia van der WULP, Tijdschr. voor Entom., vol. 23, 1880, p. 159.

CONOSIA IRRORATA Wiedemann.

Limnobia irrorata WIEDEMANN, Aussereur. zweifl. Insekt., vol. 1, 1828, p. 574.

Seven females from Buitenzorg, Java, January 10, 1909, to March 25, 1909; one female from Batavia, Java, February 26, 1909; the material collected by Bryant and Palmer. This insect is probably the most widely distributed crane-fly in the Old World. It ranges from northeastern Africa throughout Asia as far north as Japan and eastward along the East Indian islands to Australia.

Tribe LIMNOPHILINI.

Genus EPIPHRAGMA Osten Sacken.

Epiphragma OSTEN SACKEN, Proc. Acad. Nat. Sci. Phila., 1859, p. 238.

EPIPHRAGMA SIGNATA de Meijere.

Epiphragma signata de MEIJERE, Tijdschr. voor Entom., vol. 54, p. 52, pl. 4, fig. 43.

One female from Tjibodas, Mount Gedé, Java, altitude 4,500 feet, collected by Bryant and Palmer.

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[1] Aussereur. zweifl. Insekt., vol. 1, 1828, p. 551, pl. 6b, fig. 12.

Genus LIMNOPHILA Macquart.

Limnophila MACQUART, Suite a Buffon, Dipteres, vol. 1, 1834, p. 95.

LIMNOPHILA AMICA, new species.

Body-coloration shiny brown; wings brown; cell R_2 very short, cell M_1 absent.

Male.—Length about 5.5 mm.; wing, 6 mm. Rostrum short, dull brown, the palpi brownish black. Antennae rather short, the segments of the flagellum oval; antennae dark brownish black throughout. Head dark brown, shiny.

Thoracic dorsum dark brown, shiny, the scutellum more yellowish. Pleura dull yellow. Halteres rather long, brown. Legs, coxae, and trochanters yellow; femora dark brown, paler at the base; tibiae black; tarsi broken. Wings pale brown, the stigma almost indistinct; veins dark brown; venation: (see pl. 44, fig. 22), *Rs* very long, straight; fork of R_{2+3} short, much shorter than its petiole; cross vein *r* far before the fork of R_{2+3}; cell M_1 absent; cells R_3 and R_5 in a line; basal deflection of Cu_1 at about two-thirds the length of cell *1st* M_2.

Abdominal tergites dark brown, with a sparse gray bloom and long white hairs; sternites yellow, with a large dark brown blotch on the middle of each segment at the base.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude 4,500 feet. (Bryant and Palmer.)

Type.—Cat. No. 19023, U.S.N.M.

This insect suggests *L. opaca* de Meijere,[1] but the cross vein *r* is far before the fork of R_{2+3}, the cell R_2 quite differently shaped, etc.

LIMNOPHILA PALMERI, new species.

Body-coloration brown; wings light brown, stigma distinct; cell M_1 present.

Male.—Length, 6.3–7 mm.; wing, 7.4–7.5 mm. Rostrum brown, the palpi rather darker. Antennae very short, dark brown, the flagellar segments decreasing rapidly in size. Front dull yellow, remainder of the head dark grayish brown.

Thoracic dorsum dull yellow, rather shiny, with three dark brown stripes which are confluent behind; the lateral stripes short, beginning behind the pseudosutural region. Pleura dull brownish yellow. Halteres rather short, light brown, the knob darker. Legs, coxae, and trochanters dull yellow, femora brown, darkened beyond the base, tibiae and tarsi dark brownish black. Wings light brown, the stigma elongate, dark brown, veins dark brown; venation: (see pl. 44, fig. 23), *Rs* long, gently arcuated at the base; petiole of cell R_2

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[1] Tijdschr. voor Entom., vol. 54, 1911, pp. 52, 53, pl. 4, fig. 44.

moderately long, a little longer than the deflection of Cu_1; cell M_1 longer than its petiole; basal deflection of Cu_1 just beyond the fork of *M*.

Abdominal tergites dark brown, the lateral margins of the segments paler brown; sternites dull brownish yellow.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude 5,000 feet. (Bryant and Palmer.)

Paratype.—Male, topotypic.

Type.—Cat. No. 19024, U.S.N.M.

The only regional form that agrees at all with this species is *L. pallidicoxa* Brunetti,[1] but here the thorax is gray, not brown, etc. *L. simplex* Brunetti[2] is much smaller; the name is preoccupied by *Limnophila simplex* Alexander[3] from the Eastern United States.

Subgenus DICRANOPHRAGMA Osten Sacken.

Dicranophragma OSTEN SACKEN, Proc. Acad. Nat. Sci. Phila., 1859, p. 240.

LIMNOPHILA (DICRANOPHRAGMA) REMOTA de Meijere.

Dicranophragma remota de MEIJERE, Tijdschr. voor Entom., vol. 56, 1914, pp. 1, 2, pl. 1, fig. 1.

One male from Buitenzorg, Java, April, 1909. Two males from Tjibodas, Mount Gedé, Java, altitude 4,500 and 9,000 feet. The material at hand was collected by Bryant and Palmer.

Genus ULA Haliday.

Ula HALIDAY, Entom. Mag., vol. 1, 1833, p. 153.

ULA JAVANICA, new species.

Body coloration brown, the pleura gray; wings light brown, cell *1st* M_2 very small.

Male.—Length about 5.5 mm.; wing, 7.4 mm. Rostrum and palpi dark-brownish black. Antennae with the basal segments dark brownish black, the flagellum broken. Head gray, a blackish mark on the middle of the vertex and occiput.

Thoracic dorsum dark brown, rather darker medially with a sparse yellowish bloom, more grayish about the pseudosutural foveae. Pleura dark brown dusted with light whitish gray, especially on the ventral sclerites. Halteres light yellow, the knob darker. Legs, coxae elongate, yellow; trochanters brownish yellow; femora dull brownish yellow, the tip a little darker; tibiae and tarsi dark brown. Wings light brown, stigma very indistinct, darker, veins brown; venation: (See pl. 44, fig. 24), Sc_2 anterior to the origin of *Rs* by a distance greater than the length of the basal deflection of Cu_1, cell

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[1] Fauna of British India, Diptera Nematocera, 1912, p. 523.

[2] Idem, pp. 523, 524.

[3] Psyche, vol. 18, 1911, pp. 198, 199.

1st M_2 very small, the basal deflection of Cu_1 just beyond the fork of *M*.

Abdomen dark brown, the hypopygium yellowish.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java; altitude 8,000 feet (Bryant and Palmer).

Type.—Cat. No. 19025, U.S.N.M.

The discovery of this genus in the Oriental region is interesting. *Ula* has been placed in the tribe Pedicini hitherto, but it should be referred to the Limnophilini. I have reared the American species, *Ula paupera* Osten Sacken,[1] from fungi, and the larva is quite Limnophiline in structure with nothing in common with the Pedicini.

Tribe HEXATOMINI.

Genus ERIOCERA Macquart.

Eriocera MACQUART, Dipt. exot., vol. 1, pt. 1, 1838, p. 74.

ERIOCERA VERTICALIS Wiedemann.

Megistocera verticalis WIEDEMANN, Aussereur. zweifl. Insekt., vol. 1, 1828, p. 56.

Three males from Bantar Gebang, Java, October 21, 1909, collected by Bryant and Palmer. The specimens offer the following measurements: Length, 9.5–11 mm.; wing, 13.6–14 mm.; antennae, 42 mm. The venation is shown in plate 44, fig. 25.

ERIOCERA ACROSTACTA Wiedemann.

Limnobia acrostacta WIEDEMANN, Dipt. exot., vol. 1, 1821, p. 14.

Two males from Tjibodas, Mount Gedé, Java, April, 1909, collected by Bryant and Palmer. The specimens offer the following measurements: Length, 24–26 mm.; wing, 17.5–17.8 mm. The venation is shown in plate 44, fig. 26.

ERIOCERA BASILARIS Wiedemann.

Limnobia basilaris WIEDEMANN, Dipt. exot., vol. 1, 1821, p. 15.

Two males and one female from Depok, Java, February 10, 1909. One male from Tjibodas, Mount Gedé, Java, April, 1909. The material was collected by Bryant and Palmer. The specimens offer the following measurements: Male, length, 15–17 mm.; wing, 10.2–12.5 mm. Female, length, 15.2 mm.; wing, 10.4 mm. The venation has never been figured, and is shown in plate 44, fig. 27.

ERIOCERA MESOPYRRHA Wiedemann.

Limnobia mesopyrrha WIEDEMANN, Aussereur. zweifl. Insekt., vol. 1, 1828, p. 26.

One female from Buitenzorg, Java, March, 1909, collected by Bryant and Palmer. The specimen offers the following measurements: Length, 23 mm.; wing, 17 mm. The wing, having never been figured, is shown in plate 44, fig. 28.

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[1] The Biology of the North American Crane Flies (Tipulidæ, Diptera) 3. The genus Ula Haliday; Journ. Ent. and Zool., vol. 7, 1915, pp. 1-9, pl. 1.

ERIOCERA CINGULATA de Meijere.

Eriocera cingulata de MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 58, 59.

One female from Depok, Java, February 10, 1909, collected by Bryant and Palmer. The specimen is larger than de Meijere's types, measuring 11 mm. in length, and with a wing-length of 13.8 mm. In de Meijere's key to the Javan Eriocerae [1] this appears as *fasciata*, new species. The wing has never been figured and is shown in plate 44, fig. 29.

Subfamily CYLINDROTOMINAE.

Genus STIBADOCERA Enderlein.

Stibadocera ENDERLEIN, Zoöl. Jahrb., vol. 32, 1912, pp. 83, 84, fig. A 2.

This genus was erected by Enderlein with *Stibadocera bullans* Enderlein of Sumatra as the type. *Cylindrotoma quadricellula* Brunetti [2] is a member of this genus. The species are all rather similar to one another and are separated mainly by slight differences of size, coloration, and venation. *S. quadricellula* (India) is the smallest species with a length of 6 to 6.5 mm. in the male sex. The genotype, *S. bullans* (Sumatra) has the head bright ochre-yellow, the thorax ochre-yellow with pale brown dorsal stripes; the male has a length of 8.5 mm., its wing, 8.7 mm., its antenna, 11mm. The species described below as *metallica*, new species (Java), is the largest of the forms as yet described with a wing of 10 mm. and an antennal length of 14 mm. in the male sex; this species has the head and thorax with decided blue-black reflections.

The species of *Stibadocera* are remarkable for the length of the antenna in the male sex; in *quadricellula* it is described as being as long as the whole body (i. e., 6.5 mm.), in the two other forms it is nearly half again as long as the body. The thorax is provided with numerous rather coarse punctures, except on the region occupied by the three praescutal stripes where the surface is quite free from punctures. The wings show the tip of R_1 present, cross-vein r usually long and simulating a section of R_1, the cross-vein r–m distinct, etc

The species of the genus range from India eastward to Java.

STIBADOCERA METALLICA, new species.

Size large (wing of the male, 10 mm., antenna, 14 mm.); head and thorax with decided blue-black reflections in certain lights.

Male.—Length, 8.8–9 mm.; wing, 10.2–10.8 mm.; antenna, 14 mm. Rostrum and palpi brown. Antennae with the two scapal

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[1] Tijdschr. voor Entom., vol. 54, 1911, pp. 59, 60.

[2] Records of the Indian Museum, vol. 6, 1911, p. 268; Fauna of British India, Diptera, 1912, p. 361, pl. 7, figs. 1, 2.

segments dull yellow, flagellum with the segments greatly elongated, provided with long outspreading hairs, flagellum brown. Head smooth, blue-black.

Praescutum chestnut brown with three metallic blue-black stripes (in the paratype reddish blue), the surface of the sclerite covered by the stripes smooth, the rest punctate; scutum, scutellum, and postnotum dark brown, thickly punctured, especially the latter. Pleurae bluish brown, densely and coarsely punctured. Halteres long, slender, brown. Legs, coxae dull brown; trochanters dull yellow; femora and tibiae dull brownish yellow; tarsi darker brown. Wings brownish gray, veins brown; venation: (see pl. 45, fig. 30), vein R_1 present, distinct; cross-vein *r* elongate, usually a little longer than the cross-vein *r-m*, sometimes shorter; R_2 atrophied at the tip.

Abdomen dark brownish black, the sternites paler.

Habitat.—Java.

Holotype.—Pangranggo, Java; altitude 9,000 feet. (Bryant and Palmer.)

Paratype.—Male, Tjibodas, Mount Gedé, Java; altitude 8,000 feet. (Bryant and Palmer.)

Type.—Cat. No. 19026, U.S.N.M.

Subfamily TIPULINAE.

Tribe DOLICHOPEZINI.

Genus NESOPEZA Alexander.

Nesopeza ALEXANDER, Canadian Entomologist, vol. 46, 1914, p. 157.

NESOPEZA GRACILIS de Meijere.

Dolichopeza gracilis de MEIJERE, Tijdschr. voor Entom., vol. 54, 1911, pp. 60, 61, pl. 4, fig. 46.

Nesopeza gracilis ALEXANDER, Canadian Entomologist, vol. 46, 1914, p. 157.

Two males from Tjibodas, Mount Gedé, Java, altitude 4,500 feet; two males, 9,000 feet (Bryant and Palmer). The material offers the following measurements: Length, 8.2–9.6 mm.; wing, 9.1–10.2 mm.

Tribe CTENOPHORINI.

Genus PSELLIOPHORA Osten Sacken.

Pselliophora OSTEN SACKEN, Berlin. Entom. Zeitschr., vol. 30, 1886, p. 165.

PSELLIOPHORA ARDENS Wiedemann.

Ctenophora ardens WIEDEMANN, Dipt. exot., vol. 1, 1821, p. 20.

One female, Buitenzorg, Java, March, 1909 (Bryant and Palmer). The insect has never been figured and is shown in plate 45, fig. 31.

PSELLIOPHORA COMPEDITA Wiedemann.

Ctenophora compedita WIEDEMANN, Dipt. exot., vol. 1, 1821, p. 21.

One male, one broken female, Depok, Java, March, 1909 (Bryant and Palmer). The wing is shown in plate 45, fig. 32.

PSELLIOPHORA RUBRA Osten Sacken.

Pselliophora rubra OSTEN SACKEN, Berlin. Entom. Zeitschr., vol 30, 1886, p. 171.

Buitenzorg, Java, male, April 4, 1909; female, March, 1909 (Bryant and Palmer). The material offers the following measurements:

Male.—Length, 13 mm.; wing, 11 mm.

Female.—Length, 16 mm.; wing, 12.5 mm. The species having never been figured, is shown in plate 45, fig. 33. This material agrees very well with Osten Sacken's brief description of this form. His type, in the British Museum, came from Mouhot, Laos. In my material the black color includes only segments 7 and 8 of the abdomen, 9 being reddish orange like the base of the abdomen; front brown, not blackish, etc.

Tribe TIPULINI.

The question concerning the various groups of species that make up the *Tipulini* should be again considered. The three genera, *Tipula* Linnæus, *Holorusia* Loew, and *Ctenacroscelis* Enderlein, are all very closely related to one another and the slight differences that are offered for their separation are scarcely equivalent to those that distinguish genera in the Limnobinæ.

Holorusia Loew[1] has the cell R_3 of the wings very narrow at its middle so that the cell is broad at both ends and shaped somewhat like an hourglass; the antennae are entirely without bristle-like hairs; femora with a semi-ctenidium of stout hairs at its tip. All of the species known to me are American (*grandis* Bergroth (Western U. S.) the genotype; *maya* Alexander (Guatemala); *flavicornis* Alexander (Venezuela); *peruviana* Alexander (Peru); *orophila* Alexander (Colombia); *laevis* Alexander (Paraguay), etc).

Ctenacroscelis Enderlein[2] has the cell R_3 of the wings very narrow as in *Holorusia;* the antennae with scattered hairs; the femora with a ctenidium near the tip. All of the species known to me are Old World forms (*praepotens* Wiedemann (East Indies, Japan); *monochrous* Wiedemann (Java); *umbrinus* Wiedemann (East Indies); *conspicabilis* Skuse (Australia); *dohrnianus* Enderlein (Sumatra), the genotype; *sikkimensis* Enderlein (India); *rex* Alexander (Burma), etc.).

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[1] Berlin Entom. Zeitschr., vol. 13, 1869, p. 3.

[2] Zoöl. Jahrbuch, vol. 32, pt. 1, 1912, pp. 1, 2.

It can readily be seen that the differences between *Tipula* and *Ctenacroscelis* are very slight and consist of the great arcuation of R_3 and the consequent narrowing of cell R_3 near its middle and the presence of a ctenidium near the tips of the femora. Some species of *Tipula* (*pedata* Wiedemann) have the ctenidium very poorly defined, the individual spines taking on the appearance of stout hairs; it is easy to figure out a transition into a perfectly normal *Tipula*.

Genus PRIONOTA van der Wulp.

Prionota van der WULP, Notes Leyden Museum, vol. 7, 1885, p. 1.

PRIONOTA NIGRICEPS van der Wulp.

Prionota nigriceps van der Wulp, Notes Leyden Museum, vol. 7, 1885, p. 2; Tijdschr. voor Entom., vol. 28, 1885, p. 82, pl. 4, figs. 3, 4.

One male, Mount Salak, Java, May 15, 1909; one female, Tjibodas, Mount Gedé, Java, April 20, 1909 (Bryant and Palmer). The specimens may be further described as follows:

Male.—Length, 15.8 mm.; wing, 14.8 mm.; antenna, 6.8 mm.

Female.—Length, 33 mm.; wing, 22.5 mm.

The wing is shown on plate 45, fig. 34.

The male hypopygium is short and subglobular, the 9th tergite from above (see pl. 47, fig. 51) almost bifid by a very deep notch, the lobes black with long dense black hairs. 9th tergite and pleurite fused into one compact mass (see pl. 47, fig. 52), the pleural portion rounded with a few scattered black hairs. Pleural appendage large, flattened, rather oval, the ends somewhat pointed; the appendage is densely covered with gray hairs so as to present a silvery appearance. 9th sternite large, not projecting caudad of the pleurite.

The curious antennae whence van der Wulp derived his generic name are figured on plate 47, fig. 50.

It is hard to understand why Doctor Enderlein[1] insists upon placing *Prionota* as a synonym of *Prionocera* Loew (=*Stygeropsis* Loew). The two genera have very little in common, the antennae of *Prionota* being provided with bristle-like hairs, those of *Stygeropsis* quite naked except for the usual pubescence. *Prionota* has a remarkable hypopygium in the male sex, the 9th tergite deeply bilobed, the tergite fused with the pleurite, etc. *Stygeropsis* has a perfectly normal Tipuline hypopygium with the 9th tergite quite distinct from the pleurite. The character of the serrations on the antennae is quite different in the two genera. It is also hard to understand why the name *Prionocera* is used. This name, proposed by Loew in 1844, is preoccupied by the same name used by Shuckard in the Coleoptera in 1839.[2]

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[1] Zool. Jahrb., vol. 32, pt. 1, 1912, p. 28.

[2] Elements of British Entomology.

The Sumatran *Prionota flaviceps* Enderlein[1] is quite distinct from *nigriceps*, which is a much larger species with a different body and wing coloration. It may be that *flaviceps* is not a true *Prionota* since it was erected on a single female specimen, in which sex the true characters of the genus are not well shown.

Genus CTENACROSCELIS Enderlein.

Ctenacroscelis ENDERLEIN, Zool. Jahrb., vol. 32, pt. 1, 1912, pp. 1, 2.

CTENACROSCELIS PRAEPOTENS Wiedemann.

Tipula praepotens WIEDEMANN, Aussereur. zweifl. Insekt., vol. 1, 1828, p. 40.

Two females, Mount Salak, Java, May 15, 1909; one female, Pelaboean Ratoe, Java, October, 1909 (Bryant and Palmer). The specimens measure as follows: Length, 40 mm.; wing, 38–40 mm. The wing is shown in plate 45, fig. 35.

CTENACROSCELIS MONOCHROUS Wiedemann.

Tipula monochroa WIEDEMANN, Aussereur. zweifl. Insekt., vol. 1, 1828, pp. 41, 42.

A male and a female, Mount Salak, May 15, 1909; a female, Pelaboean Ratoe, Java, October, 1909 (Bryant and Palmer). The wing is shown in plate 45, fig. 36. The following additional notes are given:

Male.—Length, 26 mm.; wing, 23.5 mm.

Female.—Length, 33–38 mm.; wing, 24.5–25.4 mm.

The erect hairs on the thorax are very conspicuous and do not occur in the related forms.

The male hypopygium may be described as follows: 9th tergite long, deeply split by a long narrow notch for about half of its apparent length, the lobes squarely truncated at their tips and densely provided with long prostrate yellow hairs, the margin of the segment with abundant short silky hairs of a yellow color (see pl. 47, fig. 53).

9th sternite and pleurite apparently fused, at least the sternite not distinct, bearing a bifid appendage at its ventro-caudal angle (see pl. 47, fig. 54); the outer arm of this appendage is shaped like a boomerang, the inner arm shaped as in the figure, extending caudad, entad, and dorsad, its pedicel slender, the tip expanded into a flattened lobe, whose margin is provided with groups of small black spicules. Viewed from beneath, this sterno-pleurite is deeply split medially by a V-shaped notch.

CTENACROSCELIS UMBRINUS Wiedemann.

Tipula umbrina WIEDEMANN, Aussereur. zweifl. Insekt., vol. 1, 1828, p. 49.
Tipula castanea MACQUART, Dipteres Exotiques, vol. 1, pt. 1, 1838, p. 54.
Tipula congruens WALKER, Proc. Linn. Soc. Lond., vol. 5, 1861, p. 231.
Ctenacroscelis sumatranus ENDERLEIN, Zool. Jahrb., vol. 32, pt. 1, 1912, p. 5.

A male and a female, Tjibodas, Mount Gedé, April 20, 1909; a male and a female, Mount Salak, May 15, 1909; a male, Depok, Java, February 10, 1909. (Bryant and Palmer.)

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[1] Zool. Jahrb., vol. 32, pt. 1, 1912, pp. 28, 29.

This material offers the following additional data:

Male.—Length, 19 mm.; wing, 23.5–24.5 mm.

Female.—Length, about 26 mm.; wing, 23–25.5 mm.

The wing is shown on plate 45, fig. 37.

The male hypopygium may be described as follows:

9th tergite long and narrow, the caudal half deeply divided by a median split, the lobes densely clothed with long gray hairs (see pl. 48, fig. 55). 9th sterno-pleurite very much as in *C. monochrous* Wiedemann, but the pleural appendage is quite differently shaped (see pl. 48, fig. 56), the outer arm broad, oval, the inner arm curved, its tip feebly chitinized.

It is probable that *Tipula fulvolateralis* Brunetti[1] is synonymous with this species, though this is somewhat uncertain. This form is certainly a *Ctenacroscelis*, as shown by the peculiar genitalia[2] the flattened 9th tergite, the long powerful 9th sterno-pleurite bearing the appendages far out at the tip of the sclerite, etc.

Genus TIPULA Linnaeus.

Tipula LINNAEUS, Syst. Natur., ed. 10, 1758, p. 585.

TIPULA PEDATA Wiedemann.

Tipula pedata WIEDEMANN, Dipt. exot., vol. 1, 1821, p. 23; Aussereur. zweifl. Insekt., vol. 1, 1828, p. 45.

Tipulodina magnicornis ENDERLEIN, Zool. Jahrb., vol. 32, pt. 1, 1912, pp. 30–32, fig. R.

Buitenzorg, Java, March, 1909, two males; April 10, 1909, one male; Pelaboean Ratoe, Java, October 12, 1909, two males and one female; Mount Salak, Java, altitude 3,000 feet, May 15, 1909, one male. (Bryant and Palmer.)

The following additional information concerning this insect is given:

Male.—Length, 16–23 mm.; wing, 15–20 mm.

Female.—Length, 30 mm.; wing, 20.5 mm.; fore leg, femur, 19.5 mm.; tibia, 24 mm.; tarsal segment one, 20.5 mm.; tarsal segments two to five, 7.5 mm.; middle leg, femur, 20.5 mm.; tibia, 20 mm.; tarsal segment one, 18 mm.; tarsal segments two to five, 8.5 mm.

The wing is shown on plate 45, fig. 38. As there shown, the radial sector is longer than in most of the series, there being considerable variation in this respect.

The male hypopygium may be described as follows:

9th tergite having the caudal margin gently concave with a prominent median lobe whose caudal margin is again gently concave; the caudal face of the tergite densely provided with black chitinized spicules (see pl. 48, fig. 57). 9th pleurite distinct, the dorso-pleural suture being complete; the sclerite is covered with rather sparse long hairs (see pl. 48, fig. 58); the pleurite bears three appendages, of which the outermost is a long slender hook, incurved near its apex and here strongly chitinized; this appendage is clothed with scattered hairs along its ventral and outer edge and with numerous zigzag teeth on the inner dorsal margin (in some specimens the margin is quite smooth and straight); the tips of these long hooks in a position of rest, decussate. Inside of this long hook are two shorter appendages, the outer being the shortest and smallest, oval, pale, the tip somewhat expanded, the entire appendage with numerous long pale hairs (see pl. 48, fig. 59); the innermost appendage is a long, slender, compressed arm with an enlarged compressed head, the cephalic or dorsal side heavily chitinized, black, the remainder pale. 9th sternite long and slender, its tip projecting far beyond the remainder of the hypopygium in a long point (see pl. 48, fig. 60).

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[1] Records of the Indian Museum, vol. 6, 1911, p. 249.

[2] Fauna of British India, Diptera Nematocera, 1912, pl. 6, fig. 15.

Doctor Enderlein has erected the genus *Tipulodina* for this insect but there seems to be no sufficient reason for retaining this name. In the first place, the name was proposed under the mistaken supposition that the insect was a Limnobine form. Secondly, none of the characters of the genus seem to differ from those of other genera, although, in some respects, the insect occupies a rather intermediate position. The straight R_3 and narrow cell *2nd A* are characters found in many species of *Tipula;* the short *Rs* is the common character of *Pachyrhina;* the shape of the cells in the median field of the wing are those of *Ctenacroscelis*, etc. The powerful male hypopygium and the unusual leg-coloration may offer generic differences, but until the related forms (*venusta* Walker, *inordinans* Walker, *cinctipes* de Meijere, *gracillima* Brunetti, *patricia* Brunetti, and others) are studied it would be decidedly premature to recognize the genus *Tipulodina*.

The rather curious pupa of *Tipula pedata* has been described as follows by de Meijere:[1] The remarkable pupa of *T. pedata* found in a pot of stagnant water with water-plants (Salatiga, Java, January, van Leeuwen). The pupal skin sent to me is 34 mm. long and 4 mm. broad, of a blackish brown color. The very long and slender, setaceous, arcuated breathing-horns are very remarkable; they measure 11 mm. in length, are of a blackish brown color, only the extreme tip which is slightly expanded is yellow; elsewhere they are almost uniform in diameter throughout except toward the base, where they are a very little enlarged. The dorsal abdominal segments bear a cross-row of tooth-like projections before the caudal margin of each; the ventral segments are quite similar, but here the median teeth on the hinder segments are longer and with a pair of shorter appendages before them. The tip of the abdomen likewise presents a number

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[1] Tijdschr. voor Entom., vol. 54, 1911, p. 64.

of tooth-like lobes. Along the lateral margin, each segment bears on either side two short tooth-like appendages, one being on the anterior half, the other on the posterior half of the segment.

Lest the student attribute too much significance to this condition of the pupa, quite different from the normal *Tipula* pupa with its short breathing-horns, I will mention a pupa of an undetermined Tipuline that is before me at this time. The specimen was taken by Dr. J. Chester Bradley at Tallulah Falls, Georgia, June 17, 1910; the stigmal horns measure 19 mm. in length, the tip slightly expanded as in *pedcta*. I do not know what species this represents, *Brachypremna* having been reared and there are very few other species that this could represent.

TIPULA UMBRINOIDES, new species.

Antennal flagellum bicolored; no dark stripe on the thoracic pleura.

Male.—Length, 17 mm.; wing, 18.5 mm. This species bears a close superficial resemblance to *Ctenacroscelis umbrinus* Wiedemann, differing as follows:

Segments of the antennal flagellum bicolored, the extreme basal portion of each segment dark brown, the remainder of the segment dull yellow (in *umbrinus* the flagellum is uniformly dark brown). Pleura darker brown and without a dark stripe so characteristic of *umbrinus*. Femora without a ctenidium. Wings (see pl. 46, fig. 39) with a brown cloud in cell *M* near its end; a second cloud in *Cu* at about two-fifths the length; venation, cell *1st* M_2 sharply pointed at its base, radial sector short and straight. Male hypopygium with the 9th tergite dark brown, the tip pale with numerous black chitinized spicules at the tip and underneath; the tergite is short (see pl. 48, fig. 61), the visible portion a little shorter than wide and the caudal margin merely concave, not bifid. Pleural appendages (see pl. 48, fig. 62), the outer lobe pale light yellow, oval, the tip a little pointed; the inner appendages two, shaped as in the figure; the larger of the two appendages densely provided with long reddish brown hairs which project beyond the genital chamber. Ninth sternite with a dense brush of pale hairs near the tip.

Habitat.—Java.

Holotype.—Mount Salak, Java, July 4, 1909, altitude above 3,000 feet (Bryant and Palmer).

Type.—Cat. No. 19027, U.S.N.M.

TIPULA GEDEHANA de Meijere.

Tipula gedehana de MEIJERE, Tijdschr. voor Entom., vol. 56, 1911, pp. 66, 67, pl. 4, fig. 47.

One male, Tjibodas, Mount Gedé, Java, September, 1909, altitude 4,000 feet; one male, 8,000 feet; two males and one female, 9,000 feet. (Bryant and Palmer.)

I identify this fly as de Meijere's species because of the agreement of the wing-pattern and venation. The color of the thorax is not quite as described, being dull yellowish with rather dark brown stripes. The male sex has never been described, and I characterize it as follows, making one of the specimens the allotype. The male hypopygium is rather unusually enlarged.

Male.—Length, 11.8–15.2 mm.; wing, 17–19.1 mm.

Female.—Length, 18.4 mm.; wing, 18.2 mm.

Male.—Antennae moderately long, if bent backward extending nearly to the wing-root; flagellar segments dark brown with a dense whitish pubescence. Thorax with the ground color grayish yellow, the stripes brown. Femora with a dark brown tip. Abdomen brown, segments 6 to 9, almost black. The other characters are as described by de Meijere.

The male hypopygium may be described as follows:

8th tergite with the ventral margin produced ventrad into a rounded lobe provided with a great brush of long yellow hairs; shaped as in the figure (see pl. 49, fig. 63). 8th sternite deeply V-shaped beneath, its caudal margin with a dense brush of long yellow hairs. 9th tergite very deeply split by a V-shaped notch, the margins of the lobes adjoining the notch with numerous pale yellow hairs. 9th pleurite rather small (see pl. 49, fig. 64), the pleural appendages two; the outermost appendage is a slender, fleshy lobe, slightly curved, directed dorsad and the tip slightly cephalad; the inner appendage is large, flattened, the dorso-cephalic angle produced into a more chitinized point shaped as in the figure.

Doctor de Meijere's type was taken at the crater of Mount Gedé in 1893.

TIPULA SUNDA, new species.

Color of the thorax light gray without stripes; wings light gray, stigma distinct, vein R_2 atrophied at its tip.

Male.—Length, 14 mm.; wing, 14.2 mm. Frontal prolongation of the head light gray above, brown on the sides, palpi dark brown. Antennae with the scapal segments light yellow, the flagellum broken. Head light gray.

Pronotum dull yellow. Mesonotal praescutum and scutum clear light gray without apparent stripes; scutellum yellowish brown; postnotum dull brownish yellow, very indistinctly dusted with gray. Pleura dull light yellow, the posterior sclerites weakly dusted with gray. Halteres light yellow, the knob brown. Legs, coxae and trochanters dull light yellow, femora dark brown, only the extreme base a little paler, tibiae and tarsi dark brown. Wings light gray, costal cell more yellowish, stigma dark brown, a clear spot beyond the stigma, veins dark brown, the veins *C* and *Sc* more yellowish; venation (see pl. 46, fig. 40), tip of R_2 beyond the cross-vein *r* atrophied; cell *1st* M_2 small.

Abdominal segments dull yellow, tergites 6 to 8 black, 9 dark brown. Hypopygium: 8th tergite very narrow above, on the sides attaining the 8th sternite. 8th sternite with the caudal margin rather squarely truncated, provided with a few hairs. 9th tergite (see pl. 49, fig. 65) rather large, subquadrate, the caudal margin deeply concave, fringed with short hairs; the caudo-lateral angles of the sclerite produced caudad into short points; a weak median impression. 9th sternopleurite (see pl. 49, fig. 66) rather large, subrounded, the pleural suture incomplete, rather short, running ventrad; outer pleural appendage elongate oval, pale, with numerous long blackish hairs, the base suddenly constricted; the inner appendage is compressed, chitinized, especially on the cephalic end where it fits into the notch of the 9th tergite.

Habitat.—Java.

Holotype.—Tjibodas, Mount Gedé, Java, altitude 9,000 feet. (Bryant and Palmer.)

Type.—Cat. No. 19028, U.S.N.M.

The specific name, *sunda,* is that of the original inhabitants of western Java—Sundanese, or "men of the soil."

This species suggests *T. cinereifrons* de Meijere[1] from Java and Borneo, but in that species the thorax is dull reddish yellow, not gray. In *cinereifrons,* also, the tip of R_2 is atrophied beyond the cross-vein *r*.

TIPULA FLAVICOSTA, new species.

Coloration dull reddish yellow, thorax without stripes; wings subhyaline with the costal cell yellow, petiole of cell M_1 very short.

Female.—Length, 13 mm; wing, 13.8 mm. Frontal prolongation of the head rather short, brown, the palpi very long, light brown. Antennae with the two basal segments dull yellow, the flagellum broken. Front dull yellowish, the posterior portions of the head grayish.

Thoracic dorsum dull reddish yellow with distinct suggestions of greenish which are probably abnormal. Pleura rather dull yellowish brown. Halteres brown. Legs, coxae and trochanters dull yellow, remainder of the legs brown. Wings with a light brown suffusion, the costal cell light yellow, stigma brown; venation: (see pl. 46, fig. 41), terminal portion of R_2 beyond *r* distinct; cell *1st* M_2 very small, pentagonal; the petiole of cell M_1 very short, less than the cross-vein *m* or *r-m;* the fork of M_1 very deep; cell *2nd A* very narrow.

Abdomen dull brownish yellow, darkening into brown on tergites 4 to 9, the apical sclerites almost black, shiny; ovipositor with the tergal valves long, gently curved downward at their tips, the sternal valves short, only about half the length of the tergal valves.

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[1] Tijdschr. voor Entom., vol. 54, 1911, p. 63, pl. 4, fig. 48.

Habitat.—Java.

Holotype.—Pelaboean Ratoe, Java, October 16, 1909. (Bryant and Palmer).

Type.—Cat. No. 19029, U. S. N. M.

Closest to *cinereifrons* de Meijere which has the tip of vein R_2 atrophied, the petiole of cell M_1 long, etc. The species may be separated by the key given later on.

TIPULA TJIBODENSIS, new species.

Color dull yellowish brown without distinct stripes; wings subhyaline, stigma and costal region dark brown; abdomen reddish yellow excepting segments 6 to 8 which are black.

Male.—Length, 12 mm.; wing, 14.6–15 mm.

Female.—Length, 14.6 mm.; wing, 12.4 mm. Frontal prolongation of the head short and stout, yellowish, palpi pale brown. Antennae short, if extended backward scarcely attaining the wing-root, the first three segments dull yellow, the remaining segments of the flagellum with the basal third black, remainder yellow, on the apical segments passing into brown. Head dark brown, the front and occiput brighter.

Thoracic dorsum dull yellowish brown, the stripes very indistinct. Pleura dull yellow. Halteres brown. Legs, coxae and trochanters dull yellow, remainder of the legs broken. Wings subhyaline or faintly brownish; costal cell and stigma dark brown, tip of the wing suffused with brown, most distinct on the outer half of cell R_3; venation as in plate 46, fig. 42.

Abdominal segments 1 to 5 dull brownish yellow, the basal sclerites somewhat brighter; 6 to 8 black; 9 reddish yellow. Hypopygium: 9th tergite deeply three notched (see pl. 50, fig. 68) the median notch deepest and broadest, its margin chitinized and receiving the tip of the powerful inner pleural appendage; 9th sternite powerful (see pl. 50, fig. 69) the pleurite completely severed by the pleural suture; pleural appendages complex, shaped as in the figure, the inner lobes compressed, chitinized, a two-pronged black hook on the outside. A group of long conspicuous hairs at the dorso-cephalic angle of the pleurite.

Habitat.—Java.

Holotype.—Male, Tjibodas, Mount Gedé, Java, altitude 4,500 feet (Bryant and Palmer).

Allotype.—Female, topotypic.

Paratype.—Male, topotypic.

Type.—Cat. No. 19030, U. S. N. M.

This species suggests *cinereifrons* de Meijere in the color of the thorax but the dark costa will separate this species off from related forms including *flavicosta*, new species, which has the costa yellowish.

TIPULA SALAKENSIS, new species.

Size very small (wing of the male about 8.5 mm.); thorax shiny reddish yellow.

Male.—Length, 7.8 mm.; wing, 8.3 mm. Frontal prolongation of the head very short, reddish brown. Antennae elongated, if bent backward nearly attaining the base of the abdomen; basal segments dull yellow, flagellar segments elongated, dark brown. Head with the front reddish yellow, the vertex and occiput dull gray.

Thorax shiny, reddish yellow, without distinct darker stripes. Pleura lighter yellow. Halteres, stem yellow, knob dark brown. Legs, coxae, and trochanters yellow; femora yellow at the base, passing into brown at about midlength; tibiae and tarsi brown. Wings with a slight suffusion of brown, stigma large, distinct, veins dark brown; venation: (see pl. 46, fig. 43), R_2 beyond *r* distinct; cell *1st* M_2 small; petiole of cell M_1 short, about as long as cell *1st* M_2; cross-vein *m-cu* punctiform or obliterated; cell *2nd A* very narrow.

Abdomen reddish yellow, segments 6 to 9 dark brownish black. Hypopygium (see pl. 49, fig. 67), the 9th tergite with a conspicuous median lobe that is expanded at its tip as shown in the figure.

Habitat.—Java.

Holotype.—Mount Salak, Java, 1909. (Bryant and Palmer.)

Type.—Cat. No. 19031, U.S.N.M.

This tiny *Tipula* is almost as small as *T. inconspicua* de Meijere,[1] which has the thorax dull, with three dark brown stripes; the wing coloration and the venation of the two species is quite different.

TIPULA GEDEHICOLA, new species.

Thoracic dorsum reddish, without apparent stripes; costal cell of the wings brownish yellow.

Male.—Length, 13.5 mm.; wing, 14.3 mm. Frontal prolongation of the head short, reddish brown, the palpi yellowish brown. Antennae rather short, the basal segments dull yellow, the flagellar segments dark brown. Front dull light yellow, vertex and occiput yellowish gray.

Thoracic dorsum reddish yellow, the postnotum clearer yellow. Pleura reddish yellow. Halteres dark brown, the apex of the knob rather pale. Legs, coxae, and trochanters reddish yellow, the remainder of the legs broken. Wings faintly suffused with brown, the costal cell brownish yellow, stigma brown; venation as in plate 46, fig. 44.

Abdomen reddish brown, segments 6 to 9 blackish. Hypopygium: 9th tergite from above deeply split by a median notch, the lobes evenly rounded at their tips, underneath densely provided with tiny black spicules (see pl. 50, fig. 70). 9th pleurite distinct, the pleural suture being complete (see pl. 50, fig. 71); pleural appendages, outermost lobe fleshy, pale, rather rectangular, the dorsocephalic angle produced, dorsad and caudad into a lobe shaped as in the figure; the inner lobe viewed from the side suggests a duck's head. 9th sternite with a dense brush of long yellow hairs from the caudal margin. (See pl. 50, fig. 72, for an enlarged view of the pleural appendages.)

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[1] Tijdschr. voor Entom., vol. 54, 1911, pp. 70, 71, pl. 4, fig. 49.

Habitat.—Java.

Holotype.—Male, Tjibodas, Mount Gedé, Java, altitude 5,000 feet; April 20, 1909. (Bryant and Palmer.)

Paratype.—Sex ?, topotypic.

Type.—Cat. No. 19032, U.S.N.M.

The group of Javan Tipulae with reddish thoracic dorsa without distinct darker stripes includes *cinereifrons* de Meijere, *gedehicola*, new species; *tjibodensis*, new species; *salakensis*, new species; and *flavicosta*, new species. They may be separated by the following key:

1. Wings with the cell *1st* M_2 very small, pentagonal, all the sides subequal; petiole of cell M_1 not longer than the cross-vein *r*.............................*flavicosta*.
   Wings with the cell *1st* M_2 not equally pentagonal, the upper face longer; petiole of cell M_1 longer than the cross-vein *r*..................................... 2.
2. Antennal flagellum bicolored.......................................*tjibodensis*.
   Antennal flagellum dark brown... 3.
3. Size small (wing, male, under 9 mm.).................................*salakensis*.
   Size larger (wing, male, over 12 mm.)................................... 4.
4. Palpi yellowish brown; tip of *R2* beyond cross-vein *r* present...........*gedehicola*.
   Palpi blackish brown; tip of *R2* beyond cross-vein *r* atrophied........*cinereifrons*.

T. flavicosta, *salakensis*, and *gedehicola* have cell *2nd A* of the wings very narrow; *T. tjibodensis* has it a little broader; *T. cinereifrons* has it broadest, quite normal.

Genus PACHYRRHINA Macquart.

Pachyrrhina MACQUART, Suite a Buffon, Dipteres, vol. 1, 1834, p. 88.

PACHYRRHINA DOLESCHALLI Osten Sacken.

Tipula javensis DOLESCHALL, Natuurkund. Tijdschr. Nederl. Indie, vol. 10, 1856, 406, pl. 3, fig. 2.

Pachyrrhina doleschalli OSTEN SACKEN, Annal. Mus. Civ. Genova, vol. 16, 1881, 399.

Pachyrrhina fallax van der WULP, Bijdragen tot de Dierk., vol. 17, 1904, p. 90.

Two females that agree with the description of this form, one from Buitenzorg, June, 1909, the other from Tjibodas, Mount Gedé, Java, April, 1909. (Bryant and Palmer.) The wing is figured on plate 46, fig. 45.

PACHYRRHINA OCHRIPLEURIS de Meijere.

Pachyrrhina ochripleuris de MEIJERE, Tijdschr. voor Entom., vol. 56, 1914, pp. 6–8.

Two females from Tjibodas, Mount Gedé, Java, August 26, 1909; altitude, 7,000 feet. (Bryant and Palmer). The species has not been figured and its wing is shown on plate 46, fig. 46.

PACHYRRHINA IMMACULATA PANGERANGENSIS, new subspecies.

A series of four males from Pangrango, altitude 9,000 feet; a male and a female from Tjibodas, Mount Gedé, 4,500 feet; a female at the latter place from an altitude of 9,000 feet. (Bryant and Palmer.)

These agree very closely with van der Wulp's characterization of the species *immaculata*[1] except in the larger size. *P. immaculata* is described as being small, with a length of 9.5 mm. in the male sex. The insect before me is much larger, and I think that it is subspecifically distinct from the typical form. The material offers the following measurements:

Male.—Length, 11.6–13.6 mm.; wing, 12.5–13.6 mm.

Female.—Length, 16.5–18 mm.; wing, 17 mm.

Type.—Cat. No. 19033, U.S.N.M.

The venation of the wing is shown on plate 46, fig. 47. The petiolate condition of cell M_1 is not found in most of the specimens of the series, this cell being normally sessile.

EXPLANATION OF THE PLATES.

PLATE 42.

Fig. 1. Wing of *Dicranomyia albitarsis.*
2. Wing of *Dicranomyia erythrina.*
3. Wing of *Dicranomyia excelsa.*
4. Wing of *Dicranomyia simplissima.*
5. Wing of *Dicranomyia carneotincta.*
6. Wing of *Geranomyia nitida.*
7. Wing of *Geranomyia linearis.*
8. Wing of *Geranomyia javanica.*
9. Wing of *Rhipidia javanensis.*
10. Wing of *Goniodineura nigriceps.*

PLATE 43.

Fig. 11. Wing of *Libnotes*, species.
12. Wing of *Libnotes montivagans.*
13. Wing of *Libnotes nigricornis.*
14. Wing of *Paratropeza ornatipennis.*
15. Wing of *Rhamphidia (Rhamphidia) apicalis*
16. Wing of *Rhamphidia (Eurhamphidia) niveitarsis.*
17. Wing of *Rhampholimnobia reticularis.*
18. Wing of *Antocha javanensis.*
19. Wing of *Atarba javanica.*

PLATE 44.

Fig. 20. Wing of *Gonomyia (Gonomyia) bryanti.*
21. Wing of *Mongoma saucia.*
22. Wing of *Limnophila amica.*
23. Wing of *Limnophila palmeri.*
24. Wing of *Ula javanica.*
25. Wing of *Eriocera verticalis.*
26. Wing of *Eriocera acrostacta.*
27. Wing of *Eriocera basilaris.*
28. Wing of *Eriocera mesopyrrha.*
29. Wing of *Eriocera cingulata.*

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[1] Tijdschr. voor Entom., vol. 34, 1891, p. 196.

PLATE 45.

Fig. 30. Wing of *Stibadocera metallica.* (R_1=Radius 1; R_3=Radius 3.)

31. Wing of *Pselliophora ardens.*

32. Wing of *Pselliophora compedita.*

33. Wing of *Pselliophora rubra.*

34. Wing of *Prionota nigriceps.*

35. Wing of *Ctenacroscelis praepotens.*

36. Wing of *Ctenacroscelis monochrous.*

37. Wing of *Ctenacroscelis umbrinus.*

38. Wing of *Tipula pedata.*

PLATE 46.

Fig. 39. Wing of *Tipula umbrinoides.*

40. Wing of *Tipula sunda.*

41. Wing of *Tipula flavicosta.*

42. Wing of *Tipula tjibodensis.*

43. Wing of *Tipula salakensis.*

44. Wing of *Tipula gedehicola.*

45. Wing of *Pachyrrhina doleschalli.*

46. Wing of *Pachyrrhina ochripleuris.*

47. Wing of *Pachyrrhina immaculata pangerangensis.*

PLATE 47.

Fig. 48. Hypopygium of *Gonomyia* (*Gonomyia*) *bryanti.*
Dorsal aspect of the pleurite.

49. Hypopygium of *Gonomyia* (*Gonomyia*) *bryanti.*
Appendages on the inner ventral side of the pleurite.

50. Antenna of *Prionota nigriceps.*
The first five segments from above.

51. Hypopygium of *Prionota nigriceps.*
Dorsal aspect. 9 *pl*=9th pleural region; *pl ap*=pleural appendage; *9t pl*=9th pleuro-tergite.

52. Hypopygium of *Prionota nigriceps.*
Lateral aspect. *9 pl t*=9th pleuro-tergite; *9s*= 9th sternite.

53. Hypopygium of *Ctenacroscelis monochrous.*
Dorsal aspect of the 9th tergite.

54. Hypopygium of *Ctenacroscelis monochrous.*
Lateral aspect. *9st pl*=9th sterno-pleurite; *9t*=9th tergite.

PLATE 48.

Fig. 55. Hypopygium of *Ctenacroscelis umbrinus.*
Lateral aspect. *9st pl*=9th sterno-pleurite; *9t*=9th tergite.

56. Hypopygium of *Ctenacroscelis umbrinus.*
Pleural appendages in a position of rest.

57. Hypopygium of *Tipula pedata.*
Dorsal aspect of the 9th tergite.

58. Hypopygium of *Tipula pedata.*
Lateral aspect. *8s*=8th sternite; *9s*, *9pl*=9th pleurite; *9t*= 9th sternite and tergite.

59. Hypopygium of *Tipula pedata.*
Lateral aspect of the inner pleural appendages.

60. Hypopygium of *Tipula pedata.*
Ventral aspect of the 9th sternite.

61. Hypopygium of *Tipula umbrinoides.*
Lateral aspect. *9t*, *9s*=9th tergite and sternite; *8t*=8th tergite.

62. Hypopygium of *Tipula umbrinoides.*
Pleural appendages viewed from the inside.

PLATE 49.

Fig. 63. Hypopygium of *Tipula gedehana*.
Lateral aspect. *7s*, *7t*, *8s*, *8t*, *9s*, *9t*=the respective sternites and tergites; *pl*=pleurite.

64. Hypopygium of *Tipula gedehana*.
The 9th segment enlarged, lateral aspect. *9s*, *9t*=9th sternite and tergite; *pl*=pleurite.

65. Hypopygium of *Tipula sunda*.
Dorsal aspect of the 9th tergite.

66. Hypopygium of *Tipula sunda*.
Lateral aspect. *9pl st.*=9th sterno-pleurite. *7s*, *8s*=sternites; *7t*, *8t*, *9t*=tergites.

67. Hypopygium of *Tipula salakensis*.
Lateral aspect. *9pl*, *9s*, *9t*=sclerites of 9th segment.

PLATE 50.

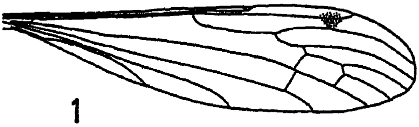
Fig. 68. Hypopygium of *Tipula tjibodensis*.
Dorsal aspect of the 9th tergite.

69. Hypopygium of *Tipula tjibodensis*.
Lateral aspect. *9pl*=9th pleurite. *8s*, *9s*=sternites; *8t*, *9t*=tergites.

70. Hypopygium of *Tipula gedehicola*.
Dorsal aspect of the 9th tergite.

71. Hypopygium of *Tipula gedehicola*.
Lateral aspect. *9pl.*=pleurite; *8s*, *9s*=sternites; *8t*, *9t*=tergites.

72. Hypopygium of *Tipula gedehicola*.
Lateral aspectof the pleural appendages.



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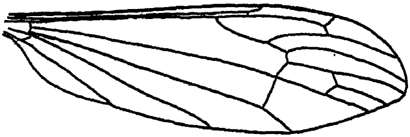

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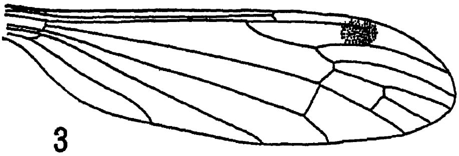

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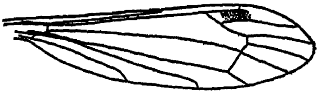

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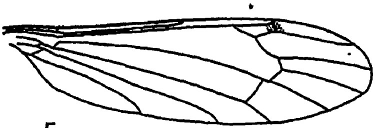

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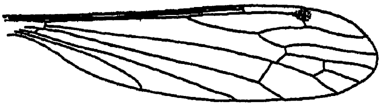

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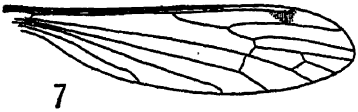

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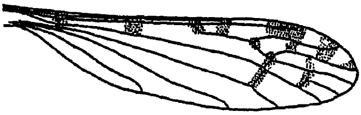

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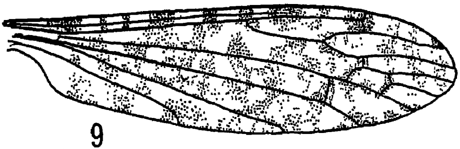

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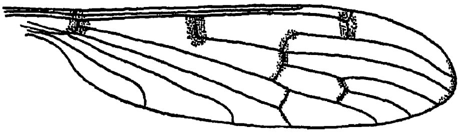

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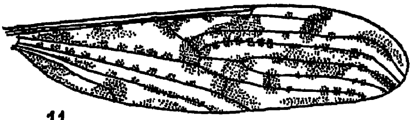
Venation of Javanese Crane Flies.

For explanation of plate see page 191.



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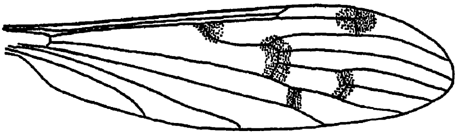

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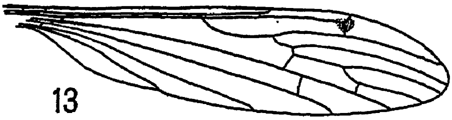

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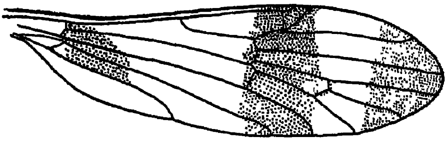

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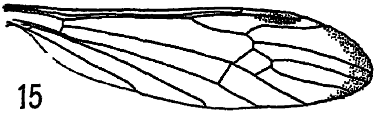

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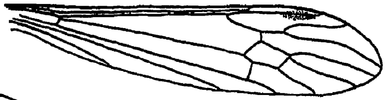

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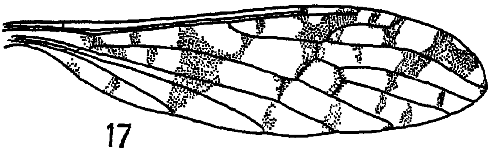

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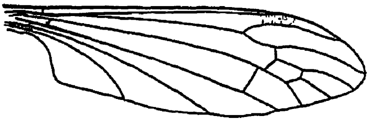

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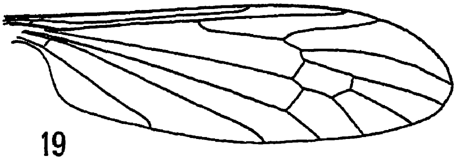

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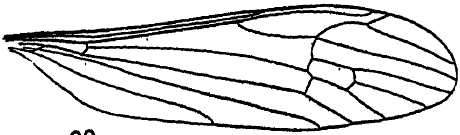
VENATION OF JAVANESE CRANE FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 191.



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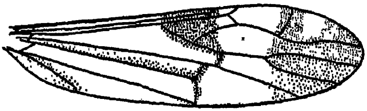

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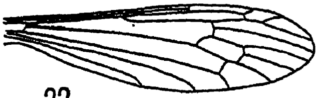

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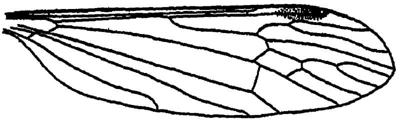

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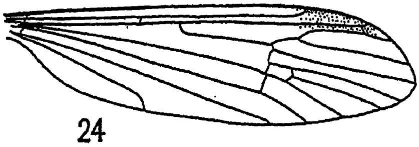

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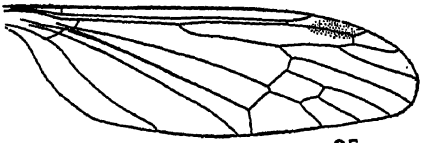

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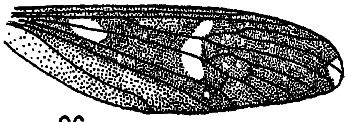

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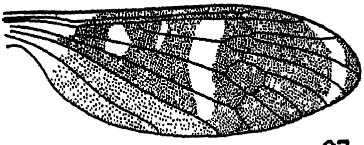

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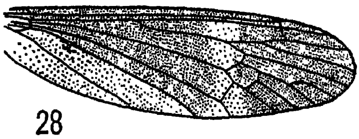

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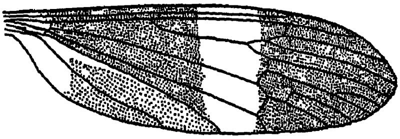

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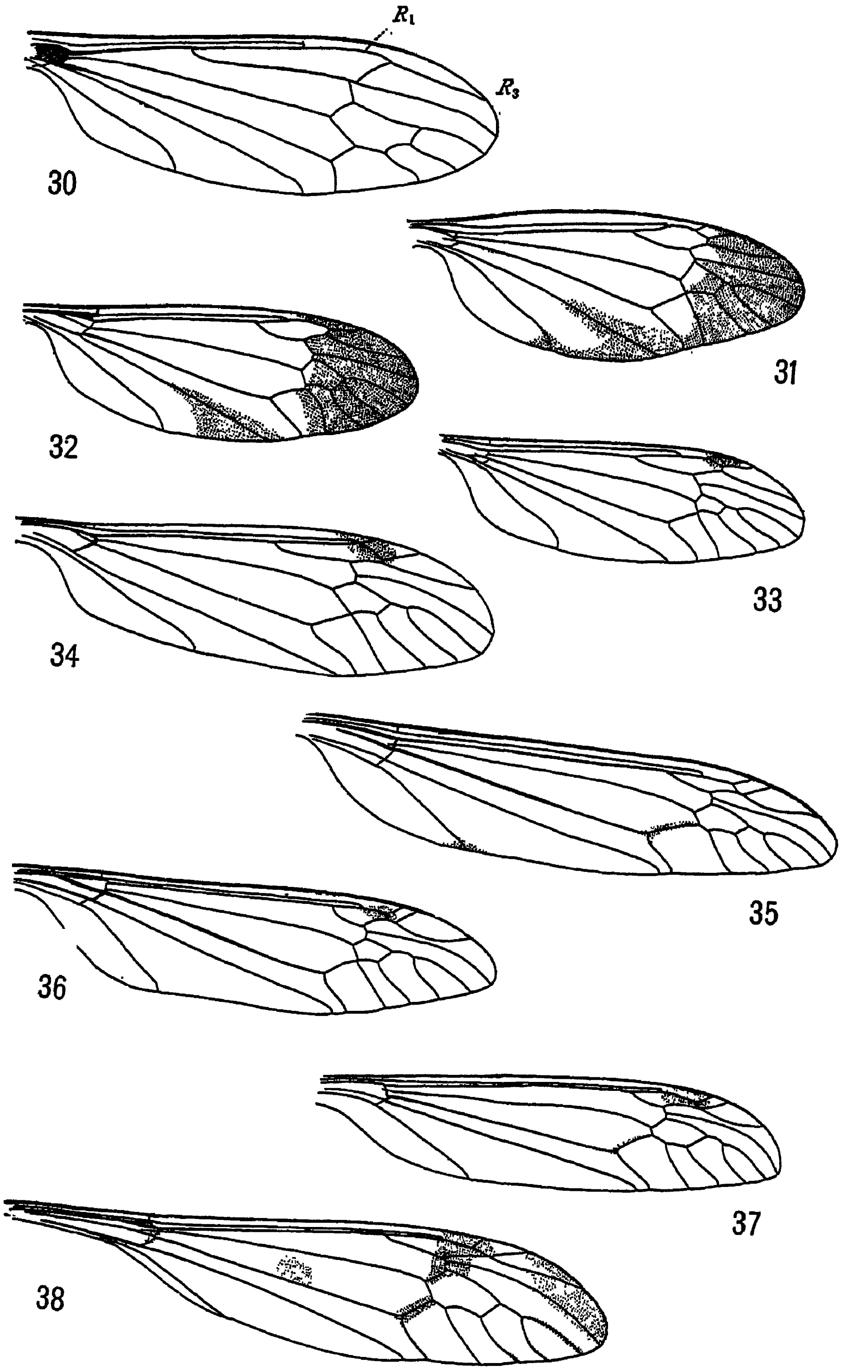
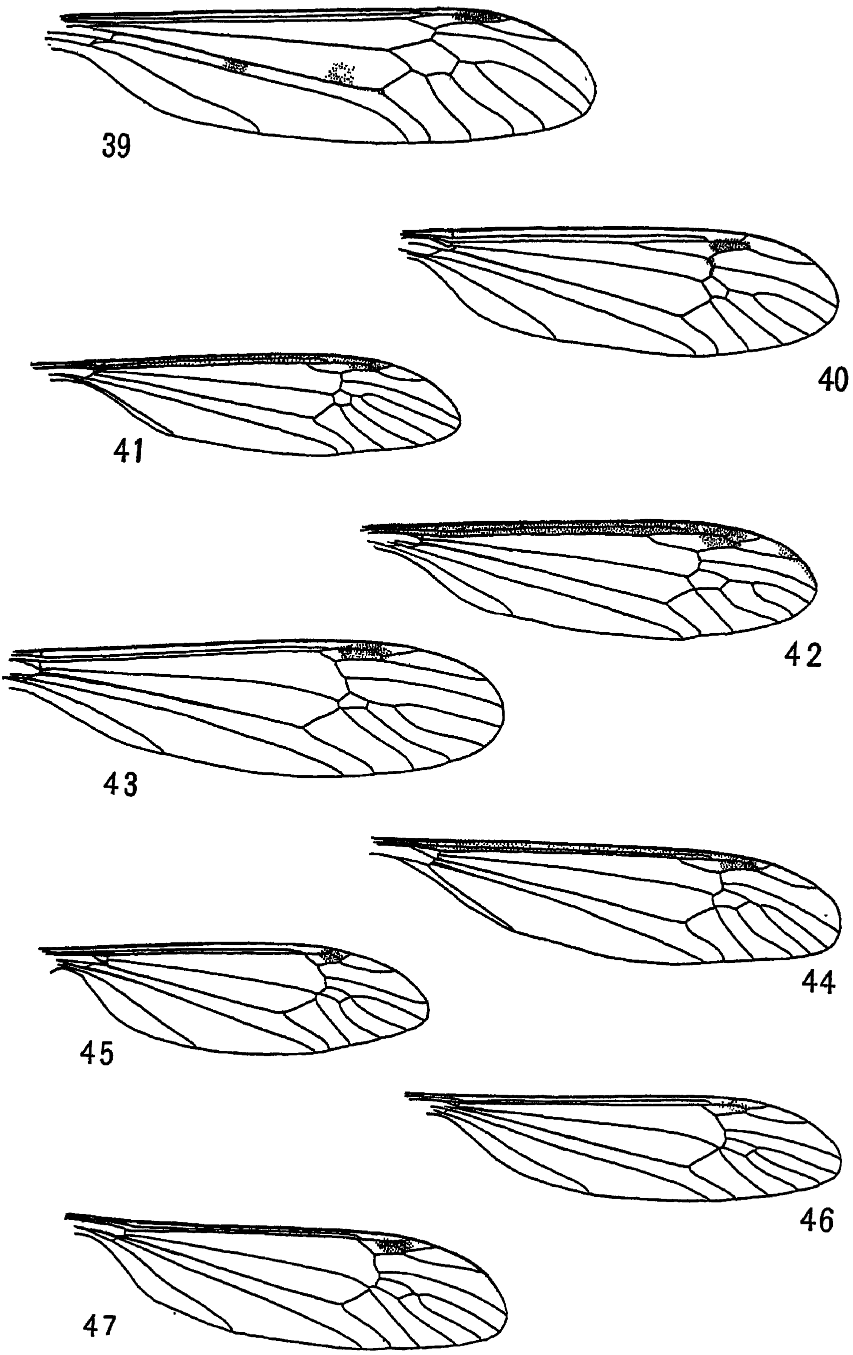
Venation of Javanese Crane Flies.

For explanation of plate see page 191.



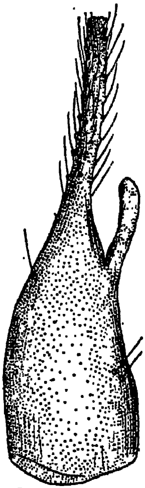
VENATION OF JAVANESE CRANE FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 192.



VENATION OF JAVANESE CRANE FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 192.



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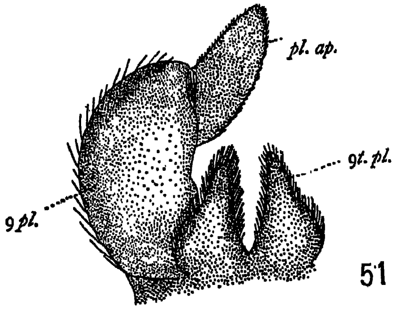

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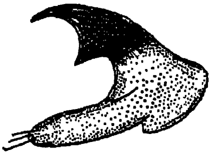

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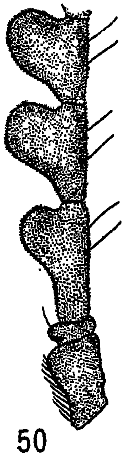

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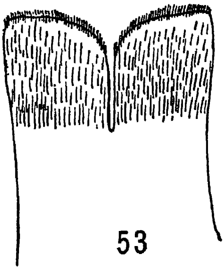

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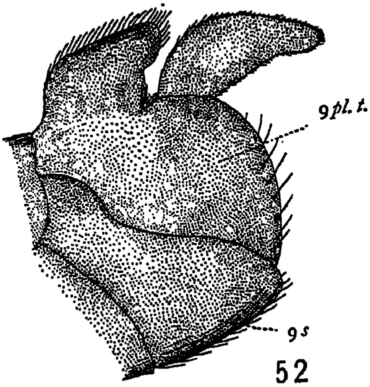

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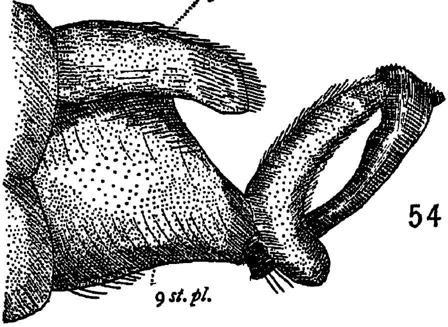
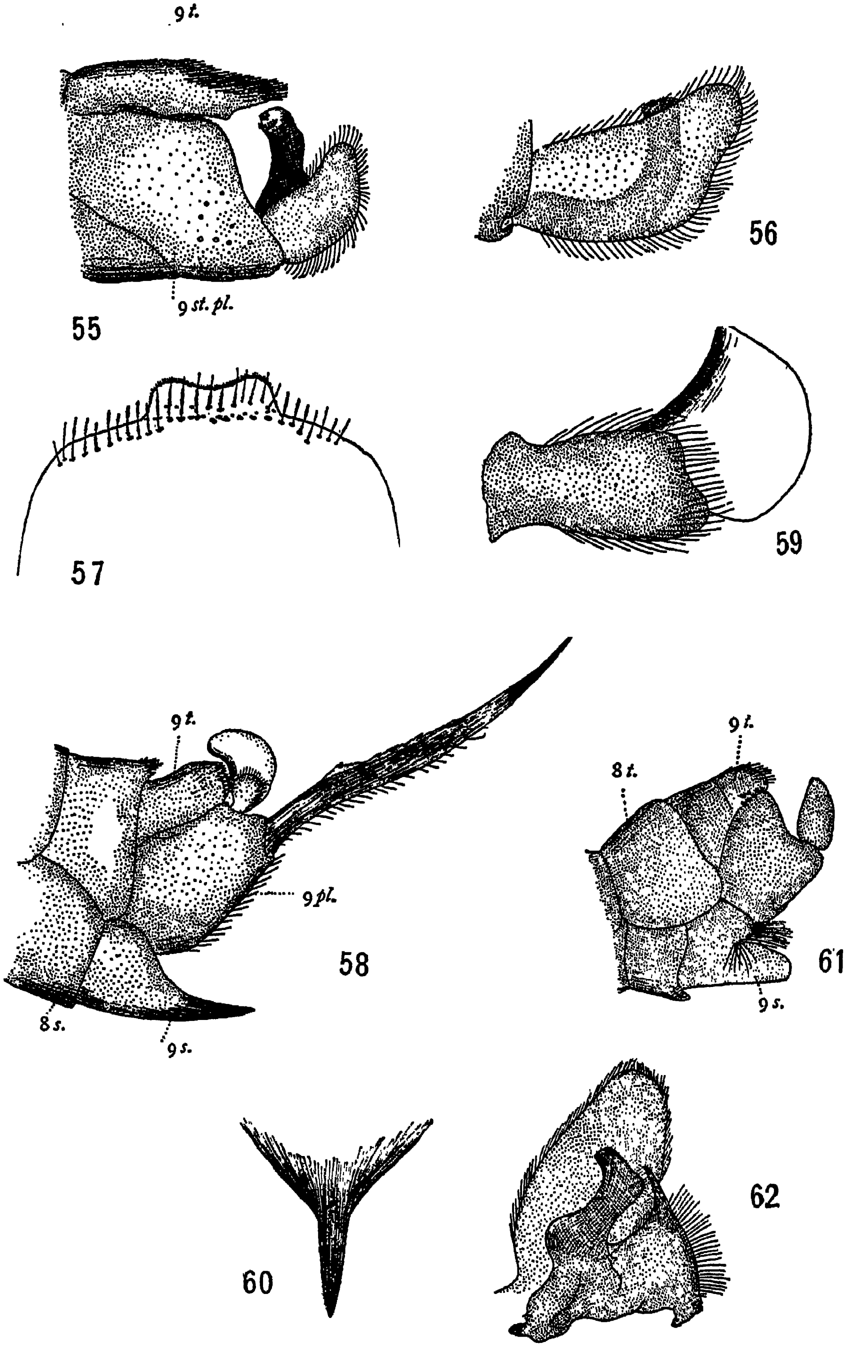


54

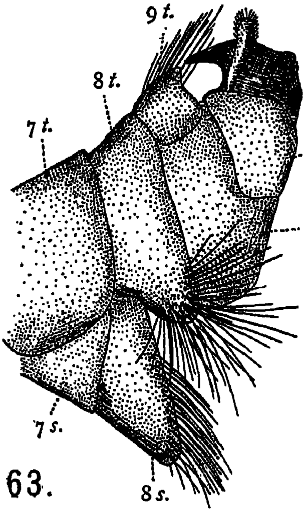
ANTENNAL AND HYPOPYGIAL STRUCTURES OF JAVANESE CRANE FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 192.



HYPOPYGIAL STRUCTURES OF JAVANESE CRANE FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 192.



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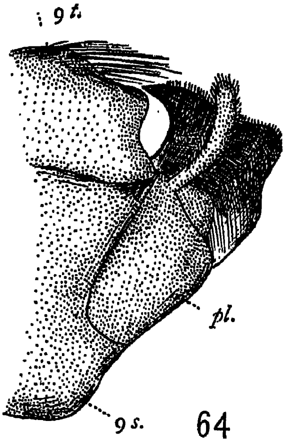

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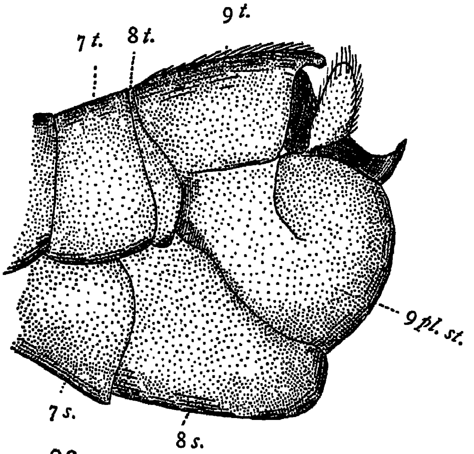

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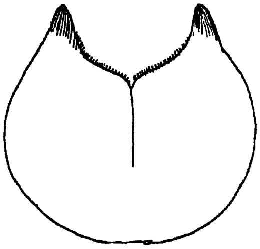

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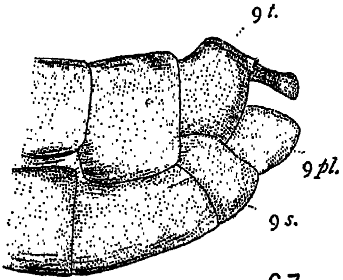
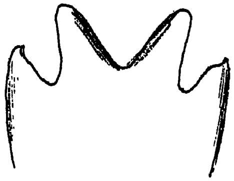


67

Hypopygial Structures of Javanese Crane Flies.

For explanation of plate see page 193.



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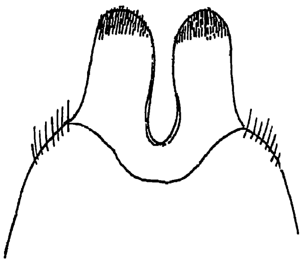

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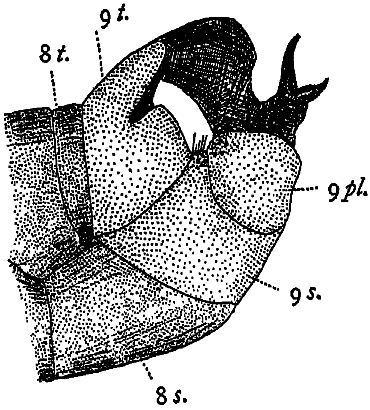

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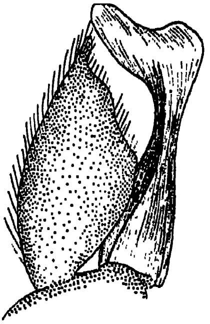

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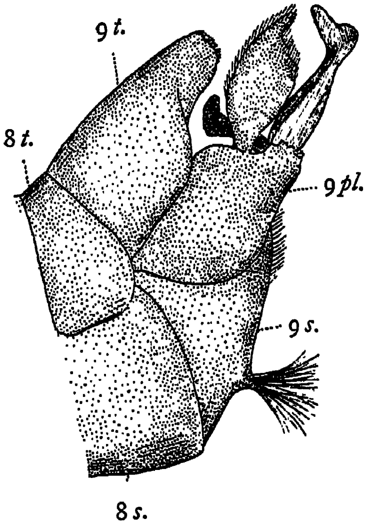

71

HYPOPYGIAL STRUCTURES OF JAVANESE CRANE FLIES.

THE PHILIPPINE LAND SHELLS OF THE GENUS SCHISTOLOMA.

By PAUL BARTSCH,

Curator, Division of Marine Invertebrates, United States National Museum.

In 1902 Dr. Wilhelm Kobelt, in his great work on the Cyclophoridae[1] substitutes the name *Schistoloma* for *Coptocheilus* Gould, which is preoccupied by *Coptochilus* Amyot and Serville, 1843, a genus of Hemiptera.

Dr. Augustus A. Gould described the genus *Coptocheilus*[2] in 1862, defining it as follows:

Shell chrysallidiform, acute, normally umbilicated, chestnut colored; aperture almost disjunct from the spire; peristome more or less double, with the internal lamina incised posteriorly. Operculum (*C. altum*) corneous, multispiral, circular, and flat. Type: *C. altum* Sowerby.

There is a character in the operculum which Gould and Kobelt seem to have overlooked, namely, that the spirals of the multispiral operculum are fused only in the very center, the broad, expanded, exceedingly thin edges being free and simply tightly appressed to each other. See figures 5, 6, and 7 on plate 51.

The Philippine shells group themselves readily under two divisions, which we may designate as subgenera, with the following characters:

Shell with a narrow slit (breathing pore) near the junction of the inner lip and the parietal wall	*Schistoloma*, ss.
Shell without a slit in the peristome	*Hololoma*, new subgenus.

The subgenus *Schistoloma* is apparently confined to part of the central islands of the Philippines. It extends from Mindoro and the two little islands, Ilin and Semerara to the south of this, eastward to Tablas, Romblon, and Sibuyan, while to the south, after apparently jumping over Panay and Guimaras, it again occurs on Negros.

The members of the subgenus arrange themselves into two groups. The one possessing a large aperture and a broadly flaring, more or less twisted peristome, extends over northern Mindoro, Romblon, Sibuyan, and Negros, while the other, which has a smaller, more circular aperture, with flatly expanded and much thickened peristome, is restricted to southern Mindoro, Ilin, Semerara, and Tablas Islands. These two groups may be considered as species—the first, *Schistoloma (Schistoloma) alta* Sowerby, and the other *Schistolma (Schistolma) mcgregori* Bartsch.

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[1] Das Tierreich, König. Preuss. Akad. Wiss. Berlin, vol. 16, p. 278.

[2] Proc. Bost. Soc. Nat. Hist., vol. 8, p. 282, 1862.

While the members of these two species present characters on the various islands that distinguish them from those of other islands, these characters represent degrees of modification rather than kind, and it is possible in some instances to find some specimens on different islands which appear absolutely identical, in spite of the fact that the average of any one set of characters, or all the characters, of a large series of specimens will give different nodes when the material from different islands is compared. This expression of different averages in the various island races demands some recognition, and I believe that this is best met by the use of trinomial names.

It is interesting to note that two of the islands harbor two forms. Mindoro has on its northeastern coast *Schistoloma alta mindoroensis* and *Schistoloma mcgregori webbi* on the south end, while Romblon has a large race of *Schistoloma alta romblonensis* and *Schistoloma alta pygmaea*, a dwarf race. These may be geographically separated, but no definite locality beyond "Romblon" appears on the label with the specimens.

It is equally interesting to find that in one instance inhabitants of two islands are so closely allied that they may be considered identical. These are *Schistoloma mcgregori webbi*, which occurs on southern Mindoro, and on the little island of Ilin, which is separated from Mindoro by a narrow strait.

The subgenus *Hololoma* seems confined to the Calamianes group, and there, as far as known, to the islands of Busuanga and Coron.

KEY TO THE SPECIES AND SUBSPECIES OF SCHISTOLOMA.

Lip with slit (*Schistoloma* s. s.).
- Aperture large with the peristome broadly flaring and irregularly reflected.
  - Inner peristome very thick .... *alta.*
  - Inner peristome not thick.
    - Inner peristome flowing over and fusing with the outer peristome.
      - Shell large, altitude more than 22.5 mm.
        - Reflected lip chocolate brown............................... *mindoroensis.*
        - Reflected lip not chocolate brown.
          - Reflected lip flesh-colored to pale brown.
            - Average altitude 24.95 mm., diameter 11.31 mm......... *romblonensis.*
            - Average altitude 23.05 mm., diameter 10.91 mm......... *sibuyanensis.*
      - Shell small, altitude less than 20 mm .... *pygmaea*

Lip with slit—Continued.
  Aperture smaller, with the peristome flatly expanded.
    Peristome chocolate brown.. *tablasensis.*
    Peristome not chocolate brown.
      Peristome flesh-colored to pale brown.
        Shell small, average diameter 9.37 mm.......................... *mcgregori.*
        Shell larger, average diameter 10.46 mm.......................... *webbi.*
Lip without slit (Hololoma).
  Average altitude 28.4 mm.. *coronensis.*
  Average altitude 25.7 mm.. *quadrasi.*

SCHISTOLOMA (SCHISTOLOMA) ALTA Sowerby.

Cyclostoma altum Sowerby, Proc. Zool. Soc. London, p. 84, 1842.
Megalomastoma altum Pfeffer, Zeitschr. f. Mal., p. 109, 1847.
Coptocheilus altum Gould, Proc. Boston Soc. Nat. Hist., vol. 8, p. 282, 1862.
Coptochilus altum, var. *protracta* Kobelt and Mollendorff, Nachrbl. Deut. Malak. Ges., vol. 29, p. 141, 1897 (*nomen nudum*).
Schistoloma altum Kobelt, Das Tierreich, vol. 16, p. 278, 1902.

Shell elongate conic, chocolate brown, with the peristome ranging from brown to flesh-colored. Nuclear whorls a little more than two, smooth, well rounded, polished, separated by a well-impressed suture. Postnuclear whorls well rounded, marked by decidedly retractive and strongly developed, closely spaced lines of growth. The spiral sculpture is variable, ranging from a few, irregularly scattered, incised lines to closely spaced, fine, spiral striations, which may cover the entire surface. Sutures somewhat constricted. Periphery of the last whorl well rounded. Base well rounded, narrowly umbilicated; a bounding fasciole to the umbilicus may be present or absent. Aperture large, irregularly oval; peristome complete, decidedly expanded, the flaring edge being irregularly curved, that is, not in one plane. There is an inner lip which may flow over and fuse with the outer lip anteriorly, being more distinct on the parietal side; this inner lip bears a notch at the junction of the columella and the parietal wall; parietal lip adnate to the body whorl.

The species breaks up into five subspecies, which are characterized chiefly by the measurements and coloration noted below.

SCHISTOLOMA (SCHISTOLOMA) ALTA ALTA Sowerby.

Plate 51, figs. 9 and 11.

Cyclostoma altum Sowerby, Proc. Zool. Soc. London, p. 84, 1842.
Megalomastoma altum Pfeffer, Zeitschr. f. Mal., p. 109, 1847.
Coptocheilus altum Gould, Proc. Boston Soc. Nat. Hist., vol. 8, p. 282, 1862.
Schistoloma altum Kobelt, Das Tierreich, vol. 16, p. 278, 1902.

In this subspecies, which comes from the Island of Negros, the peristome is very thick. The lip is usually flesh-colored, though at times pale brown.

The eighteen specimens which we have seen give the following measurements:

Cat. No. 104757, U.S.N.M.; altitude, 26.5 mm.; diameter, 11.2 mm. Negros. (Figured).
Cat. No. 104757, U.S.N.M.; altitude, 25.0 mm.; diameter, 11.0 mm. Negros.
Cat. No. 184576, U.S.N.M.; altitude, 25.8 mm.; diameter, 11.0 mm. Negros.
Cat. No. 184756, U.S.N.M.; altitude, 23.7 mm.; diameter, 11.0 mm. Negros.
Cat. No. 20158, U.S.N.M.; altitude, 24.0 mm.; diameter, 11.0 mm. Negros.
Webb Collection; altitude, 27.8 mm.; diameter, 12.6 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 25.5 mm.; diameter, 11.2 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 25.0 mm.; diameter, 11.6 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 27.4 mm.; diameter, 12.5 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 25.5 mm.; diameter, 12.6 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 25.3 mm.; diameter, 12.0 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 26.5 mm.; diameter, 12.5 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 26.5 mm.; diameter, 11.9 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 24.5 mm.; diameter, 12.0 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 28.2 mm.; diameter, 12.6 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 26.5 mm.; diameter, 12.4 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 27.7 mm.; diameter, 11.7 mm. Bay of Cala Cala, Negros.
Webb Collection; altitude, 27.8 mm; diameter, 11.7 mm. Negros.
Average, altitude, 26.07 mm.; diameter, 11.81 mm.
Greatest, altitude, 28.2 mm.; diameter, 12.6 mm.
Least, altitude, 23.7 mm.; diameter, 11.0 mm.

SCHISTOLOMA (SCHISTOLOMA) ALTA MINDOROENSIS, new subspecies.

Plate 51, figs. 1 and 3.

In this subspecies, which comes from northeastern Mindoro, the peristome is always chocolate brown.

The seventeen specimens below give the following measurements:

Cat. No. 195736, U.S.N.M.; altitude, 25.4 mm.; diameter, 11.8 mm. Mindoro (figured type).
Cat. No. 195736, U.S.N.M.; altitude, 24.6 mm.; diameter, 11.3 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.5 mm.; diameter, 11.5 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.6 mm.; diameter, 11.4 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.0 mm.; diameter, 11.4 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.0 mm.; diameter, 11.0 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.7 mm.; diameter, 11.0 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 25.3 mm.; diameter, 11.3 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 26.0 mm.; diameter, 11.1 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.4 mm.; diameter, 11.4 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 23.3 mm.; diameter, 11.3 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 24.4 mm.; diameter, 11.2 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 23.5 mm.; diameter, 11.0 mm. Mindoro.
Cat. No. 195736, U.S.N.M.; altitude, 23.8 mm.; diameter, 11.1 mm. Mindoro.
Cat. No. 257515, U.S.N.M.; altitude, 27.5 mm.; diameter, 12.5 mm. Colapan, Mindoro.
Cat. No. 257515, U.S.N.M.; altitude, 25.0 mm.; diameter, 11.1 mm. Colapan, Mindoro.
Cat. No. 257515, U.S.N.M.; altitude, 24.8 mm.; diameter, 11.0 mm. Colapan, Mindoro.
Average, altitude, 24.69 mm.; diameter, 11.32 mm.
Greatest, altitude, 27.5 mm.; diameter, 12.5 mm.
Least, altitude, 23.3 mm.; diameter 11.0 mm.

SCHISTOLOMA (SCHISTOLOMA) ALTA ROMBLONENSIS, new subspecies.

In this subspecies, which comes from Romblon Island, the lip is flesh-colored to pale brown. The shell itself has a greenish tinge.

The six specimens which we have seen give the following measurements:

Cat. No. 296609, U.S.N.M.; altitude, 24.9 mm.; diameter, 11.1 mm. Romblon.
Webb collection; altitude, 25.2 mm.; diameter, 11.1 mm. Romblon.
Webb collection; altitude, 24.5 mm.; diameter, 11.1 mm. Romblon.
Webb collection; altitude, 26.6 mm.; diameter, 12.6 mm. Romblon.
Webb collection; altitude, 26.0 mm.; diameter, 11.7 mm. Romblon.
Webb collection; altitude, 22.5 mm.; diameter, 10.3 mm. Romblon.
Average, altitude, 24.95 mm.; diameter, 11.31 mm.
Greatest, altitude, 26.6 mm.; diameter, 12.6 mm.
Least, altitude, 22.5 mm.; diameter, 10.3 mm.

SCHISTOLOMA (SCHISTOLOMA) ALTA SIBUYANENSIS, new subspecies.

In this subspecies, which comes from Sibuyan Island, the lip varies from dark chocolate brown to flesh-colored. The shell itself, in perfect condition, has a greenish tinge, while in the worn specimens the usual chestnut color prevails.

This may be what von Möllendorff listed as *Coptochilus altum protracta*, a *nomen nudum*.

Thirty specimens of this subspecies measure:

Cat. No. 130873, U.S.N.M.; altitude, 23.7 mm.; diameter, 11.3 mm. Sibuyan.
Cat. No. 130873, U.S.N.M.; altitude, 25.5 mm.; diameter, 11.5 mm. Sibuyan.
Cat. No. 130873, U.S.N.M.; altitude, 25.4 mm.; diameter, 11.2 mm. Sibuyan.
Cat. No. 130873, U.S.N.M.; altitude, 25.5 mm.; diameter, 10.5 mm. Sibuyan.
Cat. No. 184581, U.S.N.M.; altitude, 24.3 mm.; diameter, 10.6 mm. Sibuyan.
Cat. No. 184581, U.S.N.M.; altitude, 25.5 mm.; diameter, 11.2 mm. Sibuyan.
Cat. No. 296613, U.S.N.M.; altitude, 24.2 mm.; diameter, 10.6 mm. Sibuyan.
Cat. No. 296613, U.S.N.M.; altitude, 23.7 mm.; diameter, 11.1 mm. Sibuyan.
Cat. No. 296612, U.S.N.M.; altitude, 24.0 mm.; diameter, 10.4 mm. San Fernando, Sibuyan.
Cat. No. 296612, U.S.N.M.; altitude, 24.8 mm.; diameter, 12.3 mm. San Fernando, Sibuyan.
Cat. No. 296612, U.S.N.M.; altitude, 26.9 mm.; diameter, 11.4 mm. San Fernando, Sibuyan.
Cat. No. 296612, U.S.N.M.; altitude, 23.5 mm.; diameter, 11.6 mm. San Fernando, Sibuyan.
Webb collection, 1689; altitude, 25.0 mm.; diameter, 11.2 mm. Sibuyan.
Webb collection, 1689; altitude, 25.9 mm.; diameter, 11.1 mm. Sibuyan.
Webb collection, 1689; altitude, 24.0 mm.; diameter, 11.0 mm. Sibuyan.
Webb collection, 1689; altitude, 23.6 mm.; diameter, 11.2 mm. Sibuyan.
Webb collection, 1689; altitude, 23.2 mm.; diameter, 11.0 mm. Sibuyan.
Webb collection, 1689; altitude, 22.7 mm.; diameter, 11.0 mm. Sibuyan.
Webb collection, 1689; altitude, 24.1 mm.; diameter, 11.4 mm. Sibuyan.
Webb collection, 1689; altitude, 24.0 mm.; diameter, 11.7 mm. Sibuyan.
Webb collection, 1689; altitude, 23.6 mm.; diameter, 11.3 mm. Sibuyan.

Webb collection, 1689; altitude, 22.7 mm.; diameter, 11.4 mm. Sibuyan.
Webb collection, 1689; altitude, 24.0 mm.; diameter, 10.6 mm. Sibuyan.
Webb collection, 1689; altitude, 25.6 mm.; diameter, 12.0 mm. Sibuyan.
Webb collection, 1689; altitude, 25.5 mm.; diameter, 12.0 mm. Sibuyan.
Webb collection, 1689; altitude, 23.5 mm.; diameter, 11.7 mm. Sibuyan.
Webb collection, 1689; altitude, 24.5 mm.; diameter, 11.3 mm. Sibuyan.
Webb collection, 1689; altitude, 24.0 mm.; diameter, 10.5 mm. Sibuyan.
Webb collection, 1689; altitude, 21.7 mm.; diameter, 10.4 mm. Sibuyan.
Webb collection, 1689; altitude, 21.9 mm.; diameter, 10.8 mm. Sibuyan.
Average, altitude, 23.05 mm.; diameter, 10.91 mm.
Greatest, altitude, 26.9 mm.; diameter, 12.3 mm.
Least, altitude, 22.1 mm.; diameter, 10.2 mm.

SCHISTOLOMA (SCHISTOLOMA) ALTA PYGMAEA, new subspecies.

This subspecies, of which we have only a single specimen, the type (Cat. No. 296608, U.S.N.M.), comes from the Island of Romblon. It has a brown lip and is much smaller than any of the other subspecies so far noted, the measurements being: alt. 19.5 mm.; diam. 9 mm.

SCHISTOLOMA (SCHISTOLOMA) McGREGORI Bartsch.

Coptocheilus mcgregori BARTSCH, Proc. U. S. Nat. Mus., vol. 37, pp. 298–299, pl. 29, fig. 15, 1909.

Shell elongate conic, chocolate brown, with the peristome ranging from flesh-colored to dark brown. Nuclear whorls a little more than two, well rounded, apparently smooth, scarcely differentiated from the succeeding turns; postnuclear whorls somewhat inflated, well rounded, marked by decidedly retractive, rather strong, closely spaced lines of growth and irregularly distributed, fine, spiral striations which are quite variable in strength. Sutures constricted; periphery of the last whorl rounded; base narrowly umbilicated, with or without a slender fasciole. Aperture almost circular, with a strong double peristome which is strongly reflected, very regular, and in one plane. The outer peristome is adnate to the base; the inner peristome bears a strong notch at the junction of the columella and parietal wall.

This species breaks up into three subspecies, as follows:

SCHISTOLOMA (SCHISTOLOMA) McGREGORI McGREGORI Bartsch.

Plate 51, figs. 2 and 4.

Coptocheilus mcgregori BARTSCH, Proc. U. S. Nat. Mus., vol. 37, pp. 298–299, pl. 29, fig. 15, 1909.

In this subspecies, which comes from Semarara Island, the peristome varies from flesh-colored to light brown.

Twenty-five specimens yield the following measurements:

Cat. No. 205181, U.S.N.M.; altitude, 20.5 mm.; diameter, 9.5 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 19.5 mm.; diameter, 9.0 mm. Semerara Id.

Cat. No. 205181, U.S.N.M.; altitude, 20.0 mm.; diameter, 9.2 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 21.3 mm.; diameter, 9.4 mm. Semerara Id
Cat. No. 205181, U.S.N.M.; altitude, 20.5 mm.; diameter, 9.5 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.6 mm.; diameter, 9.2 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.7 mm.; diameter, 9.5 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.0 mm.; diameter, 9.4 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.0 mm.; diameter, 9.1 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.9 mm.; diameter, 9.3 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.7 mm.; diameter, 9.1 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 19.0 mm.; diameter, 9.4 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.5 mm.; diameter, 9.4 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.0 mm.; diameter, 9.6 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.4 mm.; diameter, 9.4 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.3 mm.; diameter, 9.3 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 19.5 mm.; diameter, 9.0 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 21.4 mm.; diameter, 9.2 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.6 mm.; diameter, 9.5 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.2 mm.; diameter, 9.3 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.6 mm.; diameter, 9.9 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.2 mm.; diameter, 9.2 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 21.0 mm.; diameter, 9.0 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.8 mm.; diameter, 9.9 mm. Semerara Id.
Cat. No. 205181, U.S.N.M.; altitude, 20.9 mm.; diameter, 9.1 mm. Semerara Id.
Average, altitude, 20.40 mm.; diameter, 9.37 mm.
Greatest, altitude, 21.4 mm.; diameter, 9.9 mm.
Least, altitude, 19.0 mm.; diameter, 9.0 mm.

SCHISTOLOMA (SCHISTOLOMA) McGREGORI TABLASENSIS, new subspecies.

In this subspecies, which comes from Tablas Island, the reflected lip is chocolate brown.

The seventeen specimens examined give the following measurements:

Cat. No. 195733, U.S.N.M.; altitude, 23.2 mm.; diameter, 10.6 mm. Tablas Id. (type)
Cat. No. 195733, U.S.N.M.; altitude, 22.0 mm.; diameter, 10.3 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 22.8 mm.; diameter, 10.2 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 23.2 mm.; diameter, 10.9 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 23.7 mm.; diameter, 10.5 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 23.7 mm.; diameter, 10.4 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 22.0 mm.; diameter, 10.3 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 22.8 mm.; diameter, 10.3 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 23.9 mm.; diameter, 10.5 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 22.3 mm.; diameter, 10.5 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 22.0 mm.; diameter, 10.2 mm. Tablas Id.
Cat. No. 195733, U.S.N.M.; altitude, 22.1 mm.; diameter, 10.2 mm. Tablas Id.
Webb collection, altitude, 23.0 mm.; diameter, 10.6 mm. Badagoz, Tablas Id.
Webb collection, altitude, 23.0 mm.; diameter, 10.6 mm. Badagoz, Tablas Id.
Webb collection, altitude, 22.3 mm.; diameter, 10.8 mm. Badagoz, Tablas Id.
Webb collection, altitude, 23.0 mm.; diameter, 10.6 mm. Badagoz, Tablas Id.
Webb collection, altitude, 22.2 mm.; diameter, 10.1 mm. Badagoz, Tablas Id.
Average, altitude, 22.77 mm.; diameter, 10.44 mm.
Greatest, altitude, 23.7 mm.; diameter, 10.9 mm.
Least, altitude, 22.0 mm.; diameter, 10.1 mm.

SCHISTOLOMA (SCHISTOLOMA) McGREGORI WEBBI, new subspecies.

In this subspecies, which comes from southern Mindoro and Ilin Island, the peristome varies from flesh-colored to light brown.

Fifteen specimens from Mindoro give the following measurements:

Cat. No. 296610, U.S.N.M.; altitude, 23.8 mm.; diameter, 11.8 mm. Caguray, Mindoro, (type).
Phil. Bur. Science No. 37, altitude, 24.0 mm.; diameter, 10.4 mm. Caguray, Mindoro.
Webb collection, altitude, 23.3 mm.; diameter, 10.3 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 21.1 mm.; diameter, 10.2 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 21.8 mm.; diameter, 10.1 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 22.5 mm.; diameter, 10.1 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 21.2 mm.; diameter, 10.1 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 23.0 mm.; diameter, 11.0 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 22.5 mm.; diameter, 10.2 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 22.8 mm.; diameter, 11.1 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 23.0 mm.; diameter, 10.5 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 22.5 mm.; diameter, 10.4 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 21.5 mm.; diameter, 10.1 mm. Mansalay Bay, Mindoro.
Webb collection, altitude, 25.0 mm.; diameter, 10.3 mm. Mangarin, Mindoro.
Webb collection, altitude, 22.3 mm.; diameter, 10.3 mm. Mangarin, Mindoro.
Average, altitude, 22.68 mm.; diameter, 10.46 mm.
Greatest, altitude, 25.0 mm.; diameter, 11.8 mm.
Least, altitude, 21.1 mm.; diameter, 10.1 mm.

Nineteen specimens from Ilin Island yield the following measurements:

Cat. No. 195734, U.S.N.M.; altitude, 25.4 mm.; diameter, 11.0 mm. Ilin Id.
Cat. No. 195734, U.S.N.M.; altitude, 24.0 mm.; diameter, 10.3 mm. Ilin Id.
Webb collection, altitude, 23.5 mm.; diameter, 11.0 mm. Ilin Id.
Webb collection, altitude, 23.0 mm.; diameter, 11.3 mm. Ilin Id.
Webb collection, altitude, 24.4 mm.; diameter, 11.2 mm. Ilin Id.
Webb collection, altitude, 24.0 mm.; diameter, 10.3 mm. Ilin Id.
Webb collection, altitude, 24.0 mm.; diameter, 10.3 mm. Ilin Id.
Webb collection, altitude, 23.9 mm.; diameter, 10.1 mm. Ilin Id.
Webb collection, altitude, 24.0 mm.; diameter, 10.9 mm. Ilin Id.
Webb collection, altitude, 24.0 mm.; diameter, 10.1 mm. Ilin Id.
Webb collection, altitude, 24.1 mm.; diameter, 10.1 mm. Ilin Id.
Webb collection, altitude, 23.3 mm.; diameter, 10.3 mm. Ilin Id.
Webb collection, altitude, 24.9 mm.; diameter, 10.8 mm. Ilin Id.
Webb collection, altitude, 21.9 mm.; diameter, 10.4 mm. Ilin Id.
Webb collection, altitude, 23.0 mm.; diameter, 10.0 mm. Ilin Id.
Webb collection, altitude, 22.0 mm.; diameter, 10.0 mm. Ilin Id.
Webb collection, altitude, 22.3 mm.; diameter, 10.0 mm. Ilin Id.
Webb collection, altitude, 22.3 mm.; diameter, 10.2 mm. Ilin Id.
Webb collection, altitude, 22.0 mm.; diameter, 10.2 mm. Ilin Id.
Average, altitude, 23.47 mm.; diameter, 10.45 mm.
Greatest, altitude, 25.4 mm.; diameter, 11.3 mm.
Least, altitude, 21.9 mm.; diameter, 10.0 mm.

SCHISTOLOMA (HOLOLOMA) QUADRASI Hidalgo.

Megalomastoma quadrasi Hidalgo, Journ. Conchyl., vol. 37, p. 305, pl. 15, fig. 5, 1889.
Coptocheilus quadrasi Kobelt and Möllendorff, Nachrbl. Deut. Malak. Ges., vol. 29, p. 141, 1897.
Coptochilus quadrasi Möllendorff, Abh. Ges. Görlitz, vol. 22, p. 186, 1898.
Coptochilus quadrasi rhodochilus Möllendorff, Abh. Ges. Görlitz, vol. 22, p. 186, 1898 (*nomen nudum*).
Schistoloma quadrasi Das Tierreich, vol. 16, p. 280, 1902.

Shell stout, subcylindric, rapidly tapering at the summit, chestnut brown. Nuclear whorls not differentiated from the postnuclear turns, apparently very finely pitted. This pitting, however, may be due to erosion. Postnuclear whorls somewhat inflated, well rounded, appressed at the summit, marked by very fine, slightly retractive, closely spaced lines of growth and exceedingly fine, irregularly distributed, spiral striations. Sutures slightly impressed; periphery of the last whorl well rounded; base moderately long, narrowly umbilicated, bearing on its middle a strong, raised spiral cord. Aperture subcircular; peristome reflected, thick, white, adnate to the base posteriorly.

This species has been reported so far only from two islands, both belonging to the Calamianes group. They are Busuanga and Coron. There is a difference in the size of the specimens occurring on these two islands, so they may be considered as two distinct subspecies.

SCHISTOLOMA (HOLOLOMA) QUADRASI QUADRASI Hidalgo.

Plate 51, figs. 8 and 10.

Megalomastoma quadrasi Hidalgo, Journ. Conchyl., vol. 37, p. 305, pl. 15, fig. 5, 1889.
Coptocheilus quadrasi Kobelt and Möllendorff, Nachrbl. Deut. Malak. Ges., vol. 29, p. 141, 1897.
Coptochilus quadrasi Möllendorff, Abh. Ges. Görlitz, vol. 22, p. 186, 1898.
Schistoloma quadrasi Das Tierreich, vol. 16, p. 280, 1902.

We have seen 125 specimens from Busuanga. Twenty-five of these, taken at random, give the following measurements:

Cat. No. 184579, U.S.N.M.; altitude, 26.1 mm.; diameter, 13 mm. Busuanga Id. (figured).
Cat. No. 184579, U.S.N.M.; altitude, 25.5 mm.; diameter, 12.5 mm. Busuanga Id.
Cat. No. 195735, U.S.N.M.; altitude, 24.6 mm.; diameter, 11.3 mm. Busuanga Id.
Cat. No. 195735, U.S.N.M.; altitude, 26.8 mm.; diameter, 13.4 mm. Busuanga Id.
Cat. No. 195735, U.S.N.M.; altitude, 27.4 mm.; diameter, 12.9 mm. Busuanga Id.
Cat. No. 195735, U.S.N.M.; altitude, 26.0 mm.; diameter, 12.4 mm. Busuanga Id.
Cat. No. 195735, U.S.N.M.; altitude, 26.0 mm.; diameter, 12.8 mm. Busuanga Id.
Cat. No. 195735, U.S.N.M.; altitude, 26.3 mm.; diameter, 13.0 mm. Busuanga Id.
Webb collection; altitude, 25.4 mm.; diameter, 12.7 mm. Busuanga Id.
Webb collection; altitude, 27.2 mm.; diameter, 12.5 mm. Busuanga Id.
Webb collection; altitude, 26.0 mm.; diameter, 13.0 mm. Busuanga Id.
Webb collection; altitude, 26.0 mm.; diameter, 12.5 mm. Busuanga Id.

Webb collection; altitude, 25.5 mm.; diameter, 12.5 mm. Busuanga Id.
Webb collection; altitude, 25.0 mm.; diameter, 12.5 mm. Busuanga Id.
Webb collection; altitude, 26.2 mm.; diameter, 12.5 mm. Busuanga Id.
Webb collection; altitude, 27.0 mm.; diameter, 13.0 mm. Busuanga Id.
Webb collection; altitude, 24.7 mm.; diameter, 12.7 mm. Busuanga Id.
Webb collection; altitude, 25.0 mm.; diameter, 13.0 mm. Busuanga Id.
Webb collection; altitude, 26.0 mm.; diameter, 13.1 mm. Busuanga Id.
Webb collection; altitude, 25.7 mm.; diameter, 12.6 mm. Busuanga Id.
Webb collection; altitude, 25.3 mm.; diameter, 13.0 mm. Busuanga Id.
Webb collection; altitude, 25.3 mm.; diameter, 12.6 mm. Busuanga Id.
Webb collection; altitude, 25.3 mm.; diameter, 12.4 mm. Busuanga Id.
Webb collection; altitude, 26.0 mm.; diameter, 13.0 mm. Busuanga Id.
Webb collection; altitude, 24.5 mm.; diameter, 12.1 mm. Busuanga Id.
Average, altitude, 25.71 mm.; diameter, 13.04 mm.
Greatest, altitude, 27.4 mm.; diameter, 13.4 mm.
Least, altitude, 24.5 mm.; diameter, 11.3 mm.

SCHISTOLOMA (HOLOLOMA) QUADRASI CORONENSIS, new subspecies.

This subspecies is uniformly larger than *quadrasi*. We have seen thirteen specimens from the Island of Coron, which give the following measurements. This is probably what was listed as *Coptochilus quadrasi rhodochilus* by von Möllendorff, which is a *nomen nudum*.[1]

Cat. No. 296611, U.S.N.M.; altitude, 28.4 mm.; diameter, 14.0 mm. Coron Id. (type).
Webb collection; altitude, 28.3 mm. diameter, 13.4 mm. Coron Id.
Webb collection; altitude, 28.1 mm. diameter, 13.3 mm. Coron Id.
Webb collection; altitude, 27.5 mm. diameter, 13.0 mm. Coron Id.
Webb collection; altitude, 28.5 mm. diameter, 13.8 mm. Coron Id.
Webb collection; altitude, 29.0 mm. diameter, 14.0 mm. Coron Id.
Webb collection; altitude, 30.0 mm. diameter, 13.2 mm. Coron Id.
Webb collection; altitude, 28.0 mm. diameter, 14.3 mm. Coron Id.
Webb collection; altitude, 27.9 mm. diameter, 14.5 mm. Coron Id.
Webb collection; altitude, 27.0 mm. diameter, 13.3 mm. Coron Id.
Webb collection; altitude, 27.1 mm. diameter, 13.0 mm. Coron Id.
Webb collection; altitude, 27.0 mm. diameter, 13.2 mm. Coron Id.
Webb collection; altitude, 26.4 mm. diameter, 13.3 mm. Coron Id.
Average, altitude, 28.4 mm.; diameter, 13.56 mm.
Greatest, altitude, 30.0 mm.; diameter, 14.5 mm.
Least, altitude, 26.4 mm.; diameter, 13.0 mm.

EXPLANATION OF PLATE 51.

Fig. 1. *Schistoloma (Schistoloma) alta mindoroensis* Bartsch, profile (type).
2. *Schistoloma (Schistoloma) mcgregori mcgregori* Bartsch, basal view (type).
3. *Schistoloma (Schistoloma) alta mindoroensis* Bartsch, basal view (type).
4. *Schistoloma (Schistoloma) mcgregori mcgregori* Bartsch, profile (type).
5. Operculum of *Schistoloma*, inner view. The light area represents the muscular attachment; the central ring, the fusing of the various laminae.
6. Same as above, lateral view, to show the arrangement of the laminae.
7. Same as above, exterior view, showing the edge of the last lamina, the inner circle indicating the fusing points of all the laminae.
8. *Schistoloma (Hololoma) quadrasi quadrasi* Hidalgo, profile.
9. *Schistoloma (Schistoloma) alta alta* Sowerby, basal view.
10. *Schistoloma (Hololoma) quadrasi quadrasi* Hidalgo, basal view.
11. *Schistoloma (Schistoloma) alta alta* Sowerby, profile.

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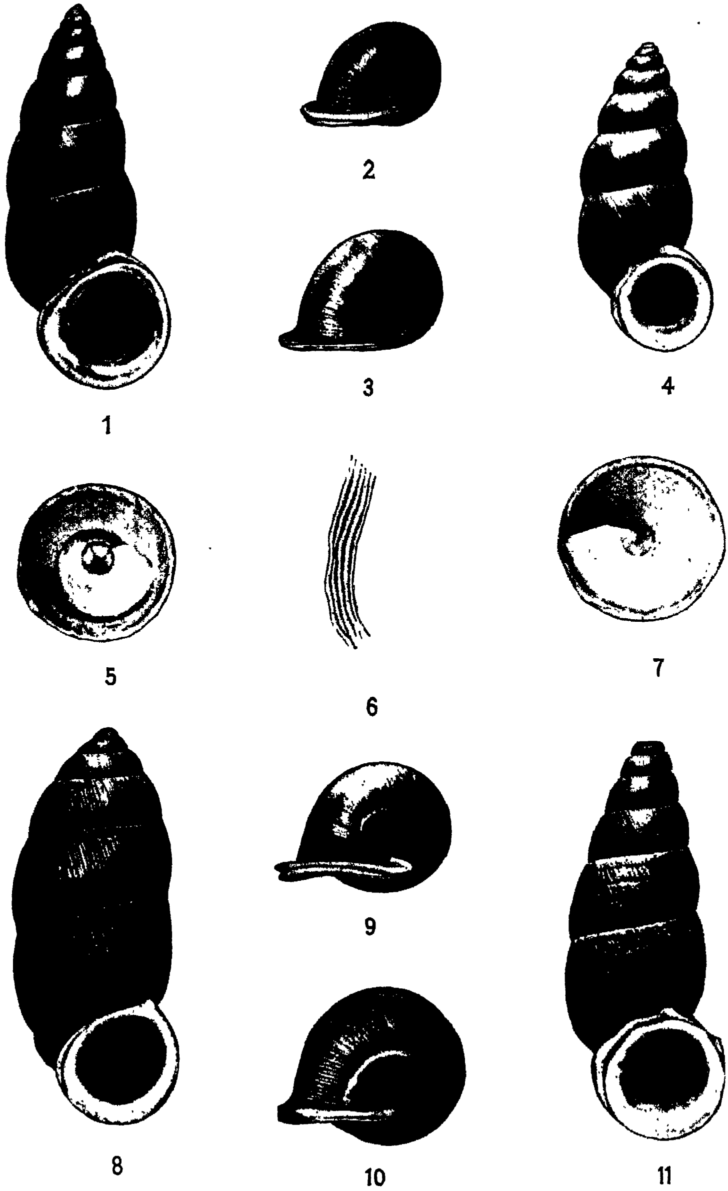
[1] Abh. Ges. Görlitz, vol. 22, p. 186, 1898.



PHILIPPINE LAND SHELLS OF THE GENUS SCHISTOLOMA.

FOR EXPLANATION OF PLATE SEE PAGE 208.

DESCRIPTIONS OF NEW SPECIES OF HYMENOPTERA.

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The following paper, which is a contribution from the Branch of Forest Insects, Bureau of Entomology, contains the descriptions of forty-seven new species of Hymenoptera, and notes on certain other species and genera. Many of the species are of economic importance in regard to the forest trees, some of them being important parasites, others of them, defoliators. In the preparation of these descriptions the Zeiss binocular microscope was used with the magnification varying from 27 to 35 diameters.

The types of all the new species are in the United States National Museum.

Family TENTHREDINIDAE.

Genus EMPHYTINA Rohwer.

EMPHYTINA VANDUZEEI, new species.

This species is readily differentiated from all the North American species by being entirely black. In the key to the Nearctic species[1] this will fall in with *inornatus* and *canadensis*, but the black legs, black pronotum, and black mesepisternum readily separate it from those species.

Female.—Length 6.5 mm. Apical margin of the clypeus depressed, deeply, subangulately emarginate, lobes broad, triangular in outline; basal portion of the clypeus convex; supraclypeal area strongly uniformly convex; supraclypeal foveae deep, not sharply differentiated from the ventral production of the antennal foveae; middle fovea shallow, circular in outline; pentagonal area with sloping walls which unite on the postocellar line; postcellar furrow rather well-defined; postocellar area well defined laterally, convex, indistinctly parted by a median furrow, shining, about twice as wide as the cephalcaudad length; postocellar line slightly shorter than the ocellocular line; antennae short, filiform; flagellum hairy, first joint distinctly but not much longer than the second; head except the postocellar area strongly opaque, with fine reticulations on a granular surface; prescutum subopaque; scutum shining; stigma broader at base, gradually tapering at apex; transverse radius strongly curved, leaving the stigma at the apex and joining the radius, almost interstitial with the third transverse cubitus; third (second) cubital cell longer than its apical width, about one and one-half times broader apically; sheath straight above, oblique from the apex to near the base when it becomes nearly straight. Black; anterior tibiae in front and a small line at the knees of the intermediate legs pale piceous wings hyaline, iridescent, venation black.

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[1] Proc. U. S. Nat. Mus., vol. 41, 1911, p. 399.

Lancaster, New York. Described from one female collected June 2, 1912, by M. C. Van Duzee, for whom the species is named.

Type.—Cat. No. 18378, U. S. N. M.

Genus DIMORPHOPTERYX Ashmead.

DIMORPHOPTERYX COLORADENSIS, new species.

This species is more closely allied to *Dimorphopteryx melanognathus* than any other described species. It may be separated from *melanognathus* by the yellow labrum, more sharply angulate emargination of the clypeus, better defined ocellar basin and the more robust sheath.

Female.—Length, 8 mm. Labrum broadly rounded; clypeus flat without a depressed apical edge, apical margin with a deep, broad V-shaped emargination, the lobes broad, triangular, in outline shaped as the shape of the emargination; supraclypeal foveae elongate, deeply, indistinctly connected with the antennal foveae; supraclypeal area small, convex; antennal furrows poorly defined; middle fovea obsolete; ocellar basin well defined above but with the walls obsolete below; postocellar area well defined laterally, anterior margin well defined by the postocellar furrow, narrowing anteriorly; the cephalo-caudad length subequal with the posterior width; the posterior margin raised into two elongate transverse tubercles; head shining; the ocellar and antennal areas punctured; posterior orbits and vertex shining, with very few punctures; prescutum and scutum shining; prescutum anteriorly with a few large punctures; mesepisternum closely punctato-reticulate above; stigma broadly rounded below, the apical margin truncate; transverse radius joining the third cubital cell slightly beyond the middle; third cubital cell on the radius subequal with the first and second; the third transverse radius arched inwardly; sheath robust, slightly concave above, subtruncate at the apex then broadly oblique to the subparallel basal portion. Black; labrum, spot on the mandibles, tegulae and four anterior legs, stramineous; antennae beyond the third joint rufopiceous; second to fourth inclusive abdominal segments, the posterior femora and tibiae except apices rufous; posterior trochanters and posterior tarsi stramineous; wings yellowish hyaline, venation except the yellow costa black.

El Paso County, Colorado. Described from one female collected June 14, 1914, by A. B. Champlain.

Type.—Cat. No. 18556, U.S.N.M.

Genus TENTHREDELLA Rohwer.

TENTHREDELLA TURNERI, new species.

This species is related to *Tenthredella mordax* (Konow) but may be differentiated from that species by the yellow angles of the pronotum and yellow tegulae. From *Tenthredella cyanata* (Konow) to which it is probably closest, this species may be separated by the color of the wings and different vertex which can not be said to be "quadrato, medio-sub-carinato."

Female.—Length, 11.5 mm. Anterior margin of the labrum obtusely pointed; clypeus convex, apical margin with a U-shaped emargination, the lobes broad, truncate; supraclypeal area depressed; supraclypeal foveae obsolete; antennal foveae well defined dorsally but reduced ventrally; antennal furrows shallow beyond the foveae; frontal basin deep, well defined, the bottom glabrous, the walls extending dorsally to the anterior ocellus; ocelli in an equilateral triangle; postocellar area well defined laterally, wider by one-fourth than the cephal-caudad length; postocellar furrow obsolete; head subopaque, finely granular, the median area around the basin and the postocellar area with coarser granulation; antennae long, filiform, third and fourth joints subequal in length; mesoscutum and prescutum granular, opaque; scutellum strongly convex, granular but more closely so than the scutum; scutellar appendage without a well defined longitudinal carina; mesepisternum sculptured like the scutum; stigma narrow, tapering; third cubital cell longer than the first two combined, its apical width as great as two-thirds its length on the radius; abdomen finely transversely aciculate; sheath parallel-sided, narrow, apex subtruncate. Black, abdomen blue; clypeus, labrum, mandibles except teeth, spot below the eye, posterior angles of the pronotum and tegulae, pale stramineous; legs stramineous; apex of the four anterior femora, the four anterior tibiae above, apex of the posterior femora above, the four anterior tarsi, the posterior tibiae and their tarsi, black wings dusky hyaline, the posterior pair paler; venation black.

Male.—Length, 9.5 mm. Differs from the female only in having the four anterior femora with the black line complete.

Shillong, Assam. Described from one female, type, and one male, allotype, collected September, 1903, by R. E. Turner, for whom the species is named.

Type.—Cat. No. 18532, U.S.N.M.

Genus PACHYPROTASIS Hartig.

PACHYPROTASIS BRUNETTII, new species.

Apparently closest to *Pachyprotasis albocincta* Cameron, but differs in a number of ways from Cameron's description, being readily separated by the black apices of the hind femora. From *Pachyprotasis violaceodorsata* to which it shows affinities it may be separated by the sides and venter being almost entirely black.

Male.—Length 7 mm. Anterior margin of the clypeus shallowly, subsquarely emarginate, the lobes triangular, obtusely pointed; labrum longer than the clypeus, truncate at the apex; supraclypeal fovea deep, punctiform; supraclypeal area uniformly convex, rectangular in outline; median fovea punctiform, small; a small crescent shaped fovea in front of the anterior ocellus; antennal furrows poorly defined; ocelli in nearly an equilateral triangle; postocellar area rectangular in outline, twice as broad as the cephal-caudad length; lateral margin of the postocellar area decidedly latrad of the posterior ocelli; antennae long, slender, flattened, beneath with two carinae, the third and fourth joints subequal; head subopaque with rather coarse punctures above the antennae, the remaining portion of the head being rather sparsely punctured; prescutum, scutum, and scutellum shining, with sparse, distinct, well defined punctures; mesepisternum opaque, rather coarsely granular; third cubital cell but little longer that the second, receiving the transverse radius a little beyond the middle; second recurrent joining the cubitus the length of the second transverse cubitus in the third cubital cell. Blue-black, variegated with stramineous; head black; clypeus, labrum, mandibles except piceous apices, head below the antennae, inner orbits almost to the vertex, posterior orbits to above the middle of the eye and an oblique spot from the upper margin of the eyes to the occiput, stramineous; scape with a small yellow spot beneath; palpi piceous thorax blue-black; sides of the prescutum, the posterior margin of the pronotum both dorsally and laterally, tegulae, spot on the anterior margin of the mesepisternum, posterior margin of the mesepimeron, metepisternum, spot on the scutellum, scutellar appendage and metanotum, stramineous; abdomen blue-black; the venter and lozenge shaped spots on the third to sixth tergites stramineous; legs stramineous; the coxae, apices of four anterior femora above, four anterior tibiae above, entire apices of the posterior femora, the posterior tibiae and all of the tarsi, black; wings hyaline with a faint yellowish tinge, iridescent; venation black.

Darjiling, Northern India. Described from three males (one, type), collected at an altitude of 7,000 feet, September 19, 1905, by Brunetti for whom the species is named. The species are labelled as being collected on flowers and hedges in gardens.

Type.—Cat. No. 18533, U.S.N.M.

Genus BLENNOCAMPA Hartig.

BLENNOCAMPA ASSAMENSIS, new name.

Blennocampa gracilicornis ROHWER, Rec. Indian Mus., vol. 8, 1913, p. 239 [not (*Selandria, Blennocampa*) *Rhadinoceraea gracilicornis* (Zaddach) Konow].

Genus PONTANIA Costa.

PONTANIA AMENTIVORA, new species.

From the sheath this species will form a new group which more closely approaches Group 2 as defined by Marlatt in his Revision of the North American Nematinae, but is readily distinct from that species group inasmuch as the ventral portion of the sheath is trilobed.

Female.—Length, 4 mm. Labrum obtusely rounded; clypeus with a shallow, narrow median emargination; lobes broad and round; supraclypeal area triangular in outline, convex; supraclypeal foveae represented by an oblique line; middle fovae elongate, obtusely pointed below and rounded above; antennal foveae large, lateral walls sloping and extending to the inner margins of the eyes; ocellar basin represented by an elongate fovae, with sloping walls, in front of the anterior ocellus; antennal furrows complete; postocellar line decidedly longer than the ocellocular line; postocellar area short, not twice the diameter of a lateral ocellus, not sharply defined anteriorly and laterally extending beyond the lateral margin of the lateral ocelli; third antennal joint slightly shorter than the fourth; third cubital cell one-fifth longer than its apical width, slightly wider apically than basally; lower discoidal cell in the hind wings distinctly shorter than the upper; nates broadly rounded apically; cerci prominent, tapering; sheath as viewed from the side narrow, acuminate at the apex; seen from beneath, the sheath, is trilobed, the concave portion filled with fine pubescence; ventral view of the sheath superficially resembles that of *Diprion;* claws cleft, the inner tooth distinctly shorter than the outer one. Black; clypeus, mandibles except apices, labrum, supracylypeal area, cheeks, the apices of the coxae, trochanters, the apices of the femora and the tibiae beneath yellowish or yellowish white; wings hyaline, iridescent, venation dark brown.

Falls Church, Virginia. Described from four females recorded under Bureau of Entomology Number Hopk. U. S. 10128, material collected, and reared, May 13, 1913, by S. A. Rohwer. This species lives, in the larval stage, in the pistillate catkins of a small species of *Salix* and causes the destruction of the ovaries and the premature forming of "cotton." It pupates with in a self-spun cocoon in the ground.

Cocoon of the normal nematine type, dark brown, covered with white silk.

Type.—Cat. No. 18313, U.S.N.M.

Genus PTERONIDEA, Rohwer.

PTERONIDEA WINNANAE Rohwer.

This species belongs to the group *trilineatae* as defined by Rohwer,[1] and in his table to the species runs it to *trilineata* Norton, but it may be readily distinguished from that species by the following synopsis which should follow as Number Two coming from the place occupied by *trilineata* in the above-mentioned table:

2. Middle fovea triangulae in outline; clypeus broadly, arcuately emarginate, the emargination broader than the lobes; hind tibiae all brown.........*trilineata.*
Middle fovea elongate; clypeus narrowly emarginate, the emargination narrower than the lobes; hind tibiae pale at base.........................*middletonia.*

The male runs in Marlatt's table to *vancouverensis* from which it may be easily distinguished by the black perscutum.

Female.—Length, 5.5 mm. Ocellar basin well defined, not extending beyond the posterior margin of the anterior ocellus; frontal crest not broken; postocellar area poorly defined anteriorly, well defined laterally by curved furrows; postocellar line subequal with the ocellocular line; third antennal joint noticeably shorter than the fourth; stigma uniformly rounded below; third cubital cell nearly of equal width, longer than its apical width; lower discal cell distinctly shorter than upper; sheath broad, straight above, broadly rounded below; teeth of the claws of equal length. Pale yellow; spot around the ocelli, antennae, spot on the scutum and prescutum, apex of the scutellum, metathorax, dorsal middle of abdomen, apex of the sheath, extreme apices of the hind tibiae and the hind tarsi, black; wings hyaline, iridescent, venation pale brown, stigma pale.

Male.—Length 4.5 mm. Ocellar basin rather more sharply defined than in the female; third cubital cell almost quadrate; hypopygidium obtusely pointed; prodecentia slightly longer than the apical width, strongly carinate, truncate apically with the angles rounded; otherwise the male agrees in structure with the female. Black; head pale except the area bounded by the antennal furrows; antennae black; pronotum, tegulae, upper margin of the mesepisternum, venter, legs except the apices of the posterior tibiae and the tarsi, pale yellow; wings like the female.

Ballston (Lacy), Virginia. Redescription from one female and three males recorded under Bureau of Entomology Number Hopk. U. S. 11316*b*, material collected, and reared September 9, 1912, by William Middleton. The larvae of this species feeds on *Salix.*

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[1] Proc. U. S. Nat. Mus., vol. 43, 1912, p. 244.

PTERONIDEA ACERIS, new species.

Female.—Length 6.5 mm. Anterior margin of the labrum truncate; clypeus short, not strongly convex, anterior margin broadly, arcuately emarginate, the lobes low, obtusely rounded apically and about half the width of the emargination in width; supraclypeal area strongly convex; middle fovea deep, almost circular in outline; frontal crest but slightly broken; antennal furrows complete above the crest; crest sharp; the lateral dorsal walls of the postocellar basin obsolete, the lower walls well defined, sharp, indicating a pentagonal ocellar basin; a small, shining fovea directly in front of anterior ocellus; postocellar line subequal in length with the ocellocular line; postocellar area not well defined laterally; the lateral furrows indicated only anteriorly and originating immediately behind the lateral margin of the lateral ocelli; antennae antenniform, the third and fourth joints subequal; thorax shining, impunctate except the setigerous punctures; stigma angulate slightly basad of the middle, tapering to the apex, broad; second recurrent and second transverse cubitus interstitial; third cubital cell slightly widening apically, about half as long as its apical width; discal cells of the hind wings of equal length; teeth of the claws subequal in length; sheath stout, straight, above, tapering from an obtusely rounded apex to a broad base. Black; labrum, mandibles except apices, clypeus, supraclypeal and lateral supraclypeal areas, spot on the inner posterior orbits, pronotum, tegula, spot on the scutellum, line on the scutellum, spot on the mesepisternum dorsally, and abdomen except infuscate basal plates, *ferruginous;* antennae brown, slightly paler beneath; legs except apical joints of the four anterior tarsi, apices of the posterior tibiae and the entire posterior tarsi which are infuscate, pallid; wings hyaline, slightly iridescent, venation dark brown.

Charter Oak, Pennsylvania. Described from one female recorded under Bureau of Entomology Number Hopk. U. S. 10708*d.* Material collected by T. E. Snyder and reared June 15, 1913, by S. A. Rohwer.

Type.—Cat. No. 18190, U.S.N.M.

This species is related to *populi* and *hudsonica* Dyar. The following table will separate it and the other species which fall in the category entitled "Angles, etc., pale," on page 45 of Marlatt's Revision of the North American Nematinae.

Clypeus, supraclypeal area black (antennal furrows not depressed sharply above the crest) .... *pulchella* Rohwer
Clypeus and supraclypeal area pale 1
1. Lateral wall of the ocellar basin obsolete; second recurrent and second transverse cubitus interstitial .... *aceris* Rohwer
Lateral wall of the ocellar basin well defined; second recurrent antifurcal....... 2
2. Lateral lobes of mesoscutum mostly black, basal segments infuscated. *populi* Marlatt
Lateral lobes of the mesoscutum reddish, basal segments pale. *hudsonii-magnus* Dyar

According to Mr. Snyder's notes the larva of *Pteronidea aceris* feeds on *Acer spicatum*. His notes are as follows:

"May 26, 1913. Sawfly larva feeding on under surface of leaf; green with blackish spots; moulted a few hours later to pale green with a yellow band near the end of the abdomen.

"May 27, 1913. Cocoon spun."

Genus LYGAEONEMATUS Konow.

LYGAEONEMATUS ROBINSONAE, new species.

Readily separated from *Lygaeonematus winnipeg* by having the upper part of the mesepisternum and part of the mesoscutum marked with pale and by characters of the head.

Female.—Length 7.5 mm. Apical margin of the labrum obtusely rounded; clypeus short, not as long as the labrum, the apex truncate; supraclypeal area triangular in outline, strongly convex; the upper margin more prominent; supraclypeal foveae deep, small, punctiform, not connected with antennal foveae; middle fovea elongate, confluent with the depression in front of the anterior ocellus; frontal crest obsolete; ocellar basin four-sided, the upper walls nearly obsolete, meeting on the postocellar furrow well above a line drawn tangent to the upper margin of the lateral ocelli; lower wall of the ocellar basin low, rounded, uninterrupted on the median fovea; postocellar area parted by a depression, well defined laterally, a little more than twice as wide as the cephalo-caudad length; postocellar furrow angulate anteriorly and not sharply defined; antennal furrows complete above the lateral angulation made by the ocellar basin; antennae slender, tapering apically, the third joint slightly shorter than the fourth; head and thorax shining; stigma broader at base, gradually tapering to an acute apex; first transverse cubitus obsolete; second recurrent almost interstitial with the second transverse cubitus; third cubital cell parallel-sided, a little more than twice as long as its apical width; upper and lower discoidal cells in the hind wings of nearly equal length, the lower being slightly shorter; abdomen shining; sheath straight above, tapering from an acute apex to a broad base. Black, marked with pale; following parts are black: Antennae, spot opposite the lower lateral walls of the ocellar basin, the ocellar area, spot on the prescutum, spot on the scutum, apex of the scutellum, metanotum, mesepisternum, sides of the episternum, and all the tergites except the apical two; remainder of the insect pale yellow; legs pale; bases of the coxae, bases of the femora (more broadly beneath) and apices of the posterior tibiae black; anterior tarsi apically, and posterior tarsi infuscated; wings hyaline, slightly iridescent; venation black except the pale yellow costa and stigma.

Boulder, Colorado. Described from one female collected May 9, 1914, by Elizabeth Robinson, for whom the species is named; specimens transmitted by Prof. T. D. A. Cockerell.

Type.—Cat. No. 14862, U.S.N.M.

Genus CROESUS Leach.

CROESUS CASTANEAE, new species.

This species may be readily separated from that group of species which has long gone under the name *latitarsus* by having the apical margin of the clypeus depressed in the interstitial second recurrent nervure and the shining mesepisternum.

Female.—Length 8 mm. Apical margin of the clypeus narrowly, subangulately emarginate, the apical margin broadly depressed, the basal area gently convex, shining; labrum much longer than the clypeus, truncate apically, sparsely clothed with long gray hair; supraclypeal area convex, triangular in outline; supraclypeal foveae deep, elongate, connected with the antennal foveae; middle fovea sharply defined, subtriangular in outline, not breaking through the frontal crest; ocellar basin pentagonal, pointed on the postocellar line, the greatest length but little greater than the greatest width; the head not noticeably depressed latrad of the ocellar basin; postocellar area defined laterally by short deep furrows; postocellar furrow nearly obsolete; postocellar line subequal with the ocellocular line; front opaque with fine aciculations; third and fourth antennal joints subequal; mesothorax shining; second recurrent vein interstitial with the second transverse cubitus; third cubital cell much longer than its apical width; sheath straight above, sharply tapering to the apex. Black; apical margin of the clypeus, the basal half of the four anterior tibiae, the basal part of the four anterior tarsi, the apices of the posterior coxae, their trochanters, and the basal third of the posterior tibiae white; wings hyaline; venation black.

Male.—Length 6 mm. Agrees with the above description of the female except that the apical margin of the clypeus is hardly depressed, and the second recurrent vein is received slightly basad of the second transverse cubitus; hypopygidium shining, narrowly rounded.

Falls Church, Virginia. Described from three females and two males recorded under Bureau of Entomology No. Hopk. U. S. 10154; material collected August 7, 1912, by William Middleton, adults emerging the following September. The larvae feed gregariously on the leaves of *Castanea dentata.* They are bright yellow with a black head and transverse black bands.

Type.—Cat. No. 18527, U.S.N.M.

Genus EUURA Newman.

EUURA COSENSII, new species.

"Undescribed gall on *Salix humilis* Marsh," COSENS, Trans. Canad. Institute, vol. 9, 1912, p. 335, 336, fig. 5 and 85.

This species runs, in the published synopsis[1] to *salicis-nodus* Walsh, but is readily differentiated from that species by the shape of the sheath and different sculpture of the head, as the following description will show:

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[1] Journ. N. Y. Ent. Soc., vol. 17, 1909, p. 9.

Female.—Length 5 mm. Anterior margin of the labrum obtusely pointed; clypeus broadly, arcuately emarginate, the lobes acute; supraclypeal area triangular in outline, supraclypeal foveae confluent with the antennal foveae, middle fovea elongate, breaking through the crest; ocellar basin with the lateral walls obsolete, the lower walls sloping; as indicated, the basin is pentagonal in outline and meets dorsally a little behind the anterior ocellus; a shining, elongate fovea in front of the anterior ocellus; antennal furrows deep, but not extending much beyond the posterior ocelli; postocellar line slightly longer than the ocellocular line; postocellar furrow deep, well defined, terminating at the inner margins of the ocelli; postocellar area flat, defined laterally by a line-like furrow, rectangular in outline and two and one-half times as broad as the cephal-caudad length; antennae stout, slightly tapering apically, third and fourth joints subequal; mesoscutum shining with a few poorly defined punctures; scutellar appendage with setigerous punctures; stigma gently rounded on the lower margin; upper and lower discal cells of equal length; sheath broad, straight above, tapering from an obtuse apex to a broad base, densely clothed with long, pale hairs; inner tooth of claws shorter than the outer. Black; mandibles except piceous apices, clypeus, labrum, palpi, supraclypeal area, posterior margins of the pronotum and tegulae, *fulvous;* posterior orbits rufo-piceous; legs below the coxae fulvous, the posterior tarsi infuscated; wings hyaline, irridescent; venation dark brown; stigma almost concolorous, pale brown.

Male.—Length 3.5 mm. Hypopygidium obtusely pointed apically, otherwise the structure agrees very well with the above description of the female. Color of the male is the same as the female, except that the posterior tarsi are more infuscated and the hypopygidium is pale.

Toronto, Ontario. Described from three females (one, type) and four males (one, allotype) which were reared from galls from the petiole of *Salix humilis*, material collected and reared by A. Cosens, for whom the species is named. This gall is well described by Cosens, and the description need not be repeated here.

Type.—Cat. No. 18528, U.S.N.M.

Family CIMBICIDAE.

Tribe CIMBICINI.

The genera belonging to this tribe, as defined in the Proceedings of the Entomological Society of Washington,[1] may be separated as follows:

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[1] Vol. 13, 1911, p. 219.

Table to the genera of the Cimbicini.

Propodeum deeply emarginate posteriorly, the emargination without a chitinous covering; third anal vein in the hind wings present; posterior femora simple........1

Propodeum hardly emarginate posteriorly; third anal vein in the hind wing wanting; posterior femora toothed beneath; labrum large, well exserted... *Trichiosoma* Leach.

1. Labrum small, not, or but scarcely, exserted.................... *Cimbex* Olivier.

Labrum large, well exserted.......................... *Cimbicisoma*, new genus.

CIMBICISOMA, new genus.

In most of the characters this genus is close to *Cimbex*, but the large well exserted labrum allies it to *Trichiosoma*, from which it may be separated by the foregoing table. Antennae seven jointed, head as in *Cimbex*, except the large labrum, which is as in *Trichiosoma*, legs and body as in *Cimbex*.

Type.—*Cimbicisoma dendrobii*, new species.

CIMBICISOMA DENDROBII, new species.

This species has a superficial resemblance to *Cimbex carinatula* Konow.

Female.—Length 18 mm., length of the anterior wing 20 mm., labrum slightly broadening apically, anterior margin rounded, the lateral margins with obtuse carinae, median area with a short well-defined carina, shining without any punctures; anterior margin of the clypeus very slightly arcuately ermaginate, the surface granular opaque; superclypeal foveae elongate, well defined; superclypeal area flat; head between the eyes opaque, finely granular, laterally coriaceous with a few sparse setigious punctures; postocellar area narrowing anteriorly, the cephal-caudal length slightly longer than the posterior width, postocellar furrow obsolete; second and third joints of the flagellum subequal in length, the apical joints not well differentiated; anterior lateral margins of the pronotum tuberculate; thorax opaque; scutellum with a median longitudinal impressed line; second recurrent vein received by the second (first) cubital cell about the length of the second transverse cubitus from its apex, transverse radius joining the radius the length of the second transverse cubitus beyond it; abdomen opaque, finely granular, apical segment slightly emarginate medianly; sheath concealed. Rufo-ferruginous; spot on the anterior margin of the prescutum, the sides and thorax beneath, and first two abdominal segments, black; legs black, except the apices of the femora, tibiae, and tarsi, which are the color of the body; wings yellowish hyaline, the submedian, median, first discoidal, radial, and the upper margin of all the cubital cells deeply infuscated, posterior wings yellowish hyaline, venation yellowish brown.

British Burmah. Described from one female which was bred by the United States Department of Agriculture from a cocoon collected on *Dendrobium hardianum* by George Field, the adult issuing May 17, 1902.

Type.—Cat. No. 18529, U.S.N.M.

Family ICHNEUMONIDAE.

Genus PEZOPORUS Förster.

PEZOPORUS (SCHENKIA) TENTHREDINARUM, new species.

This species is placed in the subgenus *Schenkia* because of its resemblance to *graminicola*, the type of *Schenkia*. It does not appear to have any described American allies to which it may be compared.

Female.—Length 6 mm. Anterior margin of the clypeus truncate with a narrow depressed edge; head below the antennae opaque, granular with a few poorly defined punctures interspread; above the antennae shining, finely granular, almost impunctate; postocellar line subequal with the ocellocular line; posterior orbits as broad as the cephalo-caudad diameter of the eye; flagellum stout, larger apically, the first joint slightly shorter than the second and a little more than twice as long as its apical width; second joint 2½ times as long as its apical width, the third, fourth, and fifth joints subequal and 1½ times as long as their apical width; malar furrow well defined and limiting the granular, opaque sculpture of the face, separating it from the shining sculpture of the posterior orbits; mandibles with the teeth of equal length; mesoscutum shining, practically impunctate; suture between the scutum and scutellum broad, shallow, bottom finely foveolate; scutellum shining, practically impunctate; propodeum opaque; the longitudinal carinae defining the basal area and the areola well defined; basal area and areola confluent; basal median lateral areas separated by a poorly defined carina which becomes subobsolete laterally; first tergite smooth, without strong sculpture, the lateral carinae extending from base to apex; second and following tergites smooth, practically impunctate; areolet hexagonal with the basal and apical ends subequal. Black; mandibles except the piceous apices, clypeus, antennae (becoming infuscated and darker apically), and tegulae white or whitish; legs rufo-ferruginous; first three tergites rufo-ferruginous, but the sides of the first and small lateral spots on the second and third, infuscate.

Male.—Length 4.5 mm. Sculpture agrees well with the female; the antennae are slightly longer and not so robust apically, the third joint is distinctly longer than the fourth; fourth and fifth are subequal, the sixth is slightly shorter than the fifth. Agrees with the female in color except the bases of the posterior coxae are black and the tergites are black except the small ferruginous spot on the apex of the first, transverse apical bands on the second and third.

Geneva, New York. Described from one female (type) and one male (allotype), reared by B. B. Fulton from a sawfly leaf miner on cherry *Profenusa collaris* MacGillivary.

Type.—Cat. No. 18503, U.S.N.M.

Genus LAGAROTIS Förster.

LAGAROTIS DIPRIONI, new species.

Female.—Length 11 mm. Clypeus shining, practically impunctate, the apical margins very slightly emarginate medianly; head below the antennae opaque, the surface finely granular and in addition with distinct, well-defined, separate punctures; a small, dark, shining tubercle on the level of the lower margin of the antennal sockets; head above the antennae to the level of the anterior ocellus punctured like the face; the vertex, the intraocellar area and posterior orbits opaque with the large punctures widely separated; ocellocular line but little longer than the interocular line; third antennal joint subequal with the two following; anterior face of the pronotum longitudinally striate, laterally and dorsally the striae are replaced by punctures similar to those of the scutum; mesoscutum shining, with distinct, well-defined punctures which are a little denser anteriorly; mesepisternum similarly sculptured; scutellum shining, with a few widely scattered, small punctures; propodeum punctured like the scutum, the areola and basal areas defined very indistinctly by irregular short carinae, the carinae defining the spiracular area well defined; first tergite with rather large, distinct punctures; the second with punctures more widely separated; the third and following without large punctures; all of the tergites, when magnified 35 diameters, with fine reticulations. Black with many yellow markings; head black; clypeus, labrum, mandibles except piceous apices, palpi, head below the supraorbital line, except intraocellar area, posterior orbits to near the top, pronotum except a median band, proepisternum, mesosternum and lower part of mesepisternum, two spots on the anterior margin of the mesoscutum which project posteriorly the median ones connected by a transverse spot, tegulae, scutellum, metanotum, and posterior part of the propodeum, yellow; abdomen rufous; the sides and apical margin of the first tergite, apical margin of the second tergite yellow; antennae fulvous; the scape and the first three flagellar joints above, piceous; legs ferruginous; the coxae, trochanters, four anterior femora and tibiae beneath, the base of the posterior tibiae yellow; the apical half of the posterior tibiae and their entire tarsi black; wings hyaline, iridescent; venation black.

Male.—Length 10 mm. The description for the female should answer well for the male. The antennae are darker and the first tergite is black; otherwise it is colored the same.

Paratypes indicate that this species may vary slightly as to the extent of the yellow on the propodeum and the yellow on the mesepisternum and mesosternum may be separated by a black line; the flagellum may be completely dusky except the four apical joints.

Falls Church, Virginia. Described from two females, one (type) recorded under Bureau of Entomology No. Hopk. U. S. 11325c and from two males (one, allotype) recorded under Bureau of Entomology No. Hopk. U. S. 10175c. These numbers refer to notes stating that this species is a primary parasite on *Diprion lecontei*, material collected and reared by William Middleton and S. A. Rohwer.

Type.—Cat. No. 18521, U.S.N.M.

LAGAROTIS VIRGINIANUS, new species.

This species is very like *Lagarotis diprioni* but may be separated from that species by having the propodeum and most of the mesepisternum black, and by having the abdomen black except whitish bands on the third and fourth tergites.

Falls Church, Virginia. Described from one male recorded under Bureau of Entomology No. Hopk. U. S. 10175c which refers to a note stating that this species is a primary parasite of *Diprion lecontei*, material collected and reared May 16, 1913, by S. A. Rohwer.

Type.—Cat. No. 18522, U. S. N. M.

Genus HOMALOMMA Förster.

This Foersterian segregate has as yet had no species placed in it. The following three species seem to agree with Foerster's and subsequent writers' conception of Foerster's genus.

The roughened cheeks, the lack of a depression separating the clypeus from the face readily separate this genus from most of the others. From *Habrodactylis* it is separated by the shorter apical joints on the hind tarsi and by the completely areolated propodeum.

Type.—*Homalomma caliroae*, new species.

The following table will differentiate the three species here considered:

Black, with white markings	*pteronideae.*
Ferruginous	1
1. Apical middle of the second tergite smooth, impunctate	*eriocampoides.*
Apical middle of the second tergite sculptured like the rest of the segment.	*caliroae.*

HOMALOMMA CALIROAE, new species.

Female.—Length 4.5 mm. Apical margin of the clypseus slightly depressed, the surface shining, almost impunctate; the entire head opaque with fine granulations, median tubercle much reduced; ocellocular line subequal with the postocellar line; postocellar area parted by a faint furrow; third and fourth antennal joints subequal; mesoscutum opaque, laterally with a few large, separate punctures; scutellum sculptured similar to the scutum but the punctures smaller and sparser; propodeum completely areolated; basal area but little wider anteriorly than posteriorly, hexagonal in outline; the anterior lateral legs subequal in length with the anterior face, and but about two-thirds the length of the lateral posterior legs; petiolate area hexagonal in outline, the anterior lateral legs slightly longer than the posterior lateral legs; propodeal spiracles round, small; nervulus interstitial; nervellus broken slightly below the middle; areolet truncate in outline, shortly petiolate; first tergite coarsely granular with two faint median carinae which extend slightly beyond the spiracles; the second tergite granular but not as coarsely so as the first, posteriorly somewhat striato-granular; the third and following tergites shining, practically impunctuate. Ferruginous; apices of the mandibles piceous; ocellar area, first tergite, anterior margin of the second tergite, fourth and following tergites, apices of the posterior tibiae and their tarsi, *black;* dorsal aspect of the propodeum piceous; antennae dark brown; face and mouth paler than the rest of the insect; wings hyaline, iridescent; venation black.

Falls Church, Virginia. Described from one female recorded under Bureau of Entomology No. Hopk. U. S. 11367, which refers to a note stating that this is a primary parasite on a species of *Eriocampoides* which feeds on *Nyssa sylvatica,* material collected and reared August 19, 1913, by William Middleton.

Type.—Cat. No. 18519, U. S. N. M.

HOMALOMMA ERIOCAMPOIDES, new species.

Female.—Length 4.5 mm. Agrees well with the description of *Homalomma caliroae*, but the following differences are to be noted: Postocellar line slightly shorter than the ocellocular line; postocellar area not parted by a faint furrow; first tergite without a median carina and more finely sculptured; the second tergite shining with fine, close punctures on the basal two-thirds; the apical portion shining, impunctate, as the third and following tergites. Ferruginous; color differs from *caliroae* as follows: The posterior median portion of the head, the sides of the mesoscutum, dorsal aspect of the propodeum, most of the second tergite, the apical margin of the third tergite, black.

Falls Church, Virginia. Described from one female recorded under Bureau of Entomology No. Hopk. U. S. 11383 which refers to a note stating that this species is a primary parasite on a species of *Eriocampoides* which feeds on *Quercus prinus.* Material collected and reared August 18, 1913, by William Middleton.

Type.—Cat. No. 18524, U.S.N.M.

HOMALOMMA PTERONIDEAE, new species.

Male.—Length 4 mm. Clypeus sculptured as the rest of the face, defined laterally by rather deep furrows; entire head rather coarsely granular, median tubercle reduced; postocellar line distinctly longer than the ocellocular line which is but little longer than the intraocellar line; third and fourth antennal joints subequal; mesoscutum finely granular with a few well defined, separate punctures interspread;

scutellum granular; mesepisternum more finely granular than the scutum; basal area about twice as wide anteriorly as posteriorly; the areola much reduced; the basal lateral areas and median lateral areas not separated; first tergite opaque, finely granular, the granulation becoming sparser posteriorly without median carinae; the second tergite uniformly finely granular, almost as long as the third and following tergites; third tergite finely granular basally, apically more shining; the fourth tergite finely granular basally, apically almost impunctate; body clothed with long, white hair. Black; face below the upper margin of the antennal sockets, mandibles except piceous apices, the lower portion of the posterior orbits, scape and pedicel beneath, small spot on the basal angles of the pronotum, tegulae, proepisternum, coxae and trochanters, *white;* legs fulvous; the anterior tibiae and tarsi pallid; apex of the posterior femora the posterior tibiae beneath, and at the apex of the posterior tarsi beyond the middle of the first joint, black; except where mentioned, the posterior tibiae and tarsi white; wings hyaline, iridescent; venation dark brown.

Falls Church, Virginia. Described from one male recorded under Bureau of Entomology No. Hopk. U. S. 11329*b*[1] which refers to a note stating that this species is a primary parasite of *Pteronidea corylus* (Cresson). Material collected and reared May 9, 1913, by William Middleton. Associated with this as a parasite of *Pteronidea corylus* was *Polyterus olympiae* Ashmead.

Type.—Cat. No. 18525, U.S.N.M.

Genus GNESIA Förster.

No species has yet been placed in this genus. The following new species goes to *Gnesia* very satisfactorily in Förster's, Davis's, and Ashmead's tables of the genera. It is therefore included and is to be considered as the type.

GNESIA CALIROAE, new species.

Female.—Length 4.5 mm. Anterior margin of the clypeus truncate, the dorsal margin gently convex, the surface shining; the head finely opaque; the area below the antennae with a few rather well defined punctures; the area above the antennae and the posterior orbits with only granulation, median tubercle short, poorly defined; ocellocular line subequal in length with the interocular line; orbit completely margined; third and fourth antennal joints subequal; mesonotum opaque, surface granular with a number of well defined separate punctures which are larger anteriorly; notauli deeply impressed but not complete; suture between the scutum and scutellum with two obscure longitudinal carinae; scutellum convex with carinae shining; propodeum completely areolated; the basal area one and one-third times as wide anteriorly as posteriorly; the areola hexagonal with its length and breadth subequal; the petiolate area large; the anterior lateral legs shorter than the posterior legs; first tergite with two longitudinal carinae which are nearly complete; the lateral carina extending to the apex and well defined, its length about one and one-third times as long as its apical width; second and third tergites of subequal length and of equal width, about twice as wide as long; the first tergite with a few poorly defined punctures; second and following tergites almost impunctate; nervellus broken slightly above the middle. Black; clypeus, mandibles except piceous apices, palpi, scape and pedicel beneath, tegulae, four anterior coxae, and the trochanters, yellow; flagellum piceous beneath; legs fulvous, the apical third of the posterior tibiae and their tarsi brownish; wings hyaline, iridescent; venation dark brown.

Falls Church, Virginia. Described from one female recorded under Bureau of Entomology No. Hopk. U. S. 11381, which refers to a note stating that this is a primary parasite on a species of *Eriocampoides* which feeds on *Nyssa sylvatica.* Material collected and reared August 10, 1913, by William Middleton.

Type.—Cat. No. 18523, U.S.N.M.

Genus POLYTERUS Förster.

POLYTERUS CALIROAE, new species.

This species is related to *Polyterus olympiae* (Ashmead), but the black face and pronotum readily differentiate it from Ashmead's species.

Male.—Length 4 mm. Head below the antennae coarsely opaque; the surface finely granular with a number of separate, distinct punctures interspread; clypeus shining, anterior margin rounded, the surface with a few separate punctures; head above the antennae finely granular, opaque, without any punctures; posterior orbits and head behind shining, almost impunctate; postocellar line distinctly longer than the ocellocular, which is but little longer than the intraocellar line; third and fourth antennal joints subequal; mesoscutum shining, polished, almost impunctate; notauli indicated anteriorly; the suture between the scutum and scutellum without foveolations; the scutellum convex, highly polished; metanotum convex, polished; propodeum shining with a few poorly defined punctures; areolations of the propodeum indicated by strong carinae; the basal area slightly wider anteriorly and not sharply differentiated from the areola which is wider posteriorly where it is defined by a slightly curved carina; the basal lateral and median lateral areas not differentiated; carinae of the first tergite extends a short distance beyond the spiracle, converging posteriorly; surface of the first tergite with irregular, fine granulations except the apex, which is almost without sculpture; second tergite about twice as wide as its median length, the basal portion with rather rough granulation, the apical portion almost impunctate; the third and following segments shining, almost impunctate. Black; clypeus, mandibles except apices, scape and pedicel beneath and legs fulvous; trochanters pallid; posterior tibiae and tarsi brownish; base of the posterior tibiae, the four anterior tarsi whitish; tegulae white; wings hyaline, iridescent; venation dark brown.

Falls Church, Virginia. Described from two males recorded under Bureau of Entomology No. Hopk. U. S. 10165, which refers to a note stating that this species is parasitic on the species of *Eriocampoides* which feeds on *Quercus rubra*. Material collected and reared June 19, 1913, by William Middleton.

Type.—Cat. No. 18520, U.S.N.M.

Genus EXENTERUS Hartig.

EXENTERUS DIPRIONI, new species.

This species is closely related to *Exenterus lophyri* Viereck but the propodeum and the first and second tergite are more rugose.

Female.—Length, 9 mm. Face with distinct, close, almost confluent punctures; frontal carina poorly defined; occiput with the punctures distinct, close; posterior orbits with the punctures smaller, similar to the occiput; third antennal joint but little shorter than the fourth and fifth; pronotum, mesoscutum, mesepisternum with close, distinct, rather small punctures, in the middle of the mesepisternum and the mesoscutum the punctures become somewhat larger; scutellum with fine, close punctures; lateral median area with distinct rather large punctures; metanotum with a few scattered punctures; propodeum with distinct rather fine punctures; the median basal area is coarsely rugose; first tergite with two longitudinal median carinae which converge posteriorly but do not unite, bending just before the yellow band; sides of the first tergite with a sharply defined carina which is arched inwardly at the basal third; surface of the tergite is coarsely reticulate, with a granular or finely punctured surface; second tergite finely punctured, its basal median area with coarse reticulations; third and following tergites with uniform close, well-defined punctures. Black; clypeus, labrum, mandibles except piceous apices, palpi, front to the top of the eyes except two black lines to the base of the antennae, posterior orbits to near the top of the eyes (narrower dorsally), scape, first three joints of the flagellum, the anterior margin of the pronotum, two lateral spots on the pronotum, two spots anteriorly on the mesoscutum, tegulae, spot anteriorly on the mesepisternum, scutellum, metanotum, two spots on the propodeum and narrow uniform bands on all the tergites, yellow; legs yellow; the apices of the posterior coxae, most of the posterior femora and a dusky spot on the apex of the posterior tibiae black; wings yellowish hyaline, slightly darker at the apex of the cubital area; venation dark brown, stigma ferruginous.

Tomahawk Lake, Wisconsin. Described from one female recorded under Bureau of Entomology No. Hopk. U. S. 10109, which refers to a note stating that this species is a primary parasite of *Diprion lecontei.* The type specimen was collected by P. C. Christensen and emerged from the cocoon October 3, 1912.

Type.—Cat. No. 18518, U.S.N.M.

Genus MOEROPHORA Förster.

MOEROPHORA NEOCLYTI, new species.

This species is readily distinguished from the other species belonging to the genus by its color, sculpture, and areolation of the propodeum.

Male.—Length 12 mm. Head below the antennae transversely irregularly striate, above the antennae transversely irregularly striate but more sparsely so; head behind the ocelli and the posterior orbits shining, the occiput with sparse, poorly defined punctures, posterior orbits with distinct, rather close, cephalo-caudad striae; prescutum not dentate, transversely striate and with a broad median depression on the basal portion; sides of the scutum finely transversely striate, the median basal portion with strong slightly oblique striae; suture between the scutum and scutellum not foveolate; sides of the pronotum with small sharp tubercles, the surface coriarious; scutellum granular, over which are fine longitudinal striae; propodeum coriarious; the basal area and the areola confluent; the areola hexagonal in outline; the posterior legs subequal with the anterior lateral legs; the basal lateral area not sharply separated from the median lateral area; the first segment finely transversely reticulate, the base of second and third segments finely longitudinally aciculate; the apices of the second and third and the entire following segments smooth, practically impunctate. Black; inner orbits to the top of the eye and a small spot below the tegula yellow; abdomen rufous; legs, except a small white spot on the outside of the posterior tibiae at the base, black; wings hyaline, iridescent; venation dark brown.

Santa Catalina Mountains, Arizona. Described from one male recorded under Bureau of Entomology No. Hopk. U. S. 10544*e* which refers to a note stating that this species is parasitic on *Neoclytis capraca* Say, in *Quercus arizonica.* Material collected by Morris Chrisman and reared, November 17, 1913, by H. B. Kirk.

Type.—Cat. No. 18421, U.S.N.M.

Genus AMERSIBIA Förster.

Alloplasta FÖRSTER.

This genus may be readily differentiated from *Meniscus* by having the fronds normal, flat or evenly convex and the angulate nervellus, which is broken at or below the middle.

AMERSIBIA PRIONOXYSTI, new species.

This species is readily differentiated from all other North American species described in this group by its size and color.

Female.—Length 19 mm.; length of ovipositor 17 mm. Clypeus shining with widely scattered distinct punctures; face opaque with rather close, distinct punctures; immediately below the antennae is a triangularly-shaped raised tubercle, the top of which is subcarinate; head above the antennae opaque, finely granular, but in addition to the granulation are distinct separate punctures; postocellar line slightly longer than the ocellocular line; third antennal joint one-fourth longer than the fourth; mesoscutum and scutellum shining with sparse, well-defined punctures; mesepisternum similarly sculptured, except at the posterior subdorsal region there is a glabrous spot; sides of the propodeum sculptured like the mesepisternum; dorsal aspect of the propodeum rather coarsely punctato-rugose with the rugosity more developed basally, with two low rounded carinae which are subparallel to near the base, when they diverge sharply; these carinae become subobsolete apically; first tergite one-fifth longer than the second, the lateral margins slightly sinuate at the spiracles, the dorsal aspect with two subcarinate, elevated portions which extend almost to the apical margin at the apex of these raised areas is a shallow fovea; first tergite coarsely coriarious with the strength of the sculpture diminished apically; disco-cubital vein with a well-defined stump; nervulus slightly postfurcal. Black; scape beneath, anterior lateral margins of the scutum, the posterior angles of the pronotum, tegulae, a spot below on the mesepisternum, and four anterior legs, yellowish or reddish yellow; posterior legs, except the tibiae above and the entire posterior tarsi which are black, rufous; wings yellowish hyaline, vitreous, venation dark brown.

Male.—Length 18 mm.; length of the antennae 15 mm. Except for the sexual characters this agrees with the above description of the female, but it has the following additional yellow markings: Clypeus, mandibles, four longitudinal spots on the face and the anterior margin of the pronotum and a spot in front of the intermediate coxae.

Cocoon.—Elongate, cylindrical, rounded at each end. Dark brown; composed of an opaque papery substance, in which is interwoven irregular strands of silk.

Falls Church, Virginia. Described from one female and one male recorded under Bureau of Entomology Number Hopk. U. S. 9839p^{10}, material collected and reared by Fritz Johansen. This species is a primary parasite on *Prionoxystus* in chestnut, and judging from the observations so far available, it kills the host larva in the fourth or fifth instar.

Type.—Cat. No. 18310, U.S.N.M.

Genus SCAMBUS Hartig.

Epiurus FÖRSTER
Iseropus FÖRSTER.

As here used the genus *Scambus* Hartig has *Epiurus* Foester and *Iseropus* Förster as synonyms, no generic differences having been observed between the genotypes, as defined by Viereck, Bull. 83, U. S. National Museum, 1914, of the genera in question.

SCAMBUS EVETRIVORUS, new species.

This species may be separated from *Scambus brunneifrons* (Viereck) in the shorter first tergite and in having the sides of the propodeum almost without sculpture. It is closely related to *Scambus nigrifrons* (Viereck) but differs from that species in puncturation and in the relatively longer ovipositor. *Scambus pterophorae* (Ashmead) which is also similar has entirely red legs and stronger carinae on the propodeum.

Female.—Length 7 mm.; length of the ovipositor 5.5 mm. Head highly polished, without punctures; the posterior orbits as broad as three-quarters of the cephalo-caudad diameter of the eye; postocellar line distinctly longer than the ocellocular line; the intraocellar line subequal with the diameter of the anterior ocellus; third antennal joint [illegible] little shorter than the fourth and fifth combined; the fifth antennal joint slightly shorter than the fourth; mesoscutum polished anteriorly, and laterally with widely separate, setigerous punctures; scutellum polished with a few widely separate, setigerous punctures; suture between the scutum and scutellum not foveolate; sides of the propodeum impunctate except for the setigerous punctures; the dorsal aspect with a few widely separated punctures; two carinae on the propodeum rather poorly defined but extending to the apex of the dorsal aspect; anterior depression of the first tergite highly polished, sharply defined dorsally by carinae; dorsal aspect of the first tergite with separate, poorly defined punctures, first tergite about as long as its apical width; the second tergite longer than the third, hardly as long as its apical width; the second and following tergites with distinct, well defined, rather large separate punctures, the punctures becoming sparser and smaller apically; nervellus broken at the middle. Black;

legs rufo-piceous; anterior coxae, the four anterior tibiae beneath, two basal joints of the four anterior tarsi beneath and tegulae white; posterior tibiae and tarsi dusky; the tibiae except at the apex beneath white; two basal joints of the tarsi, except at apices, white; wings hyaline, iridescent; venation dark brown; base of the stigma pallid.

Fort Bayard, New Mexico. Described from two females recorded under Bureau of Entomology No. Hopk. U. S. 12101*c* which refers to a note stating that this is a parasite on *Evetria buschnelli* Busck infesting *Pinus ponderosa*, material reared September 7, 1913, by Carl Heinrich.

Type.—Cat. No. 18517, U.S.N.M.

Genus ORTHOPELMA Taschenberg.

ORTHOPELMA LUTEOLATOR (Gravenhorst).

This European species has been reared from galls of *Rhodites rosae* (Linnaeus) collected at Weyland, Massachusetts, by F. C. Craighead. Adults reared, May 21, 1913, by William Middleton. The following description may be useful to American students:

Female.—Length 4.5 mm. Head below the antennae shining with a few poorly defined, scattered punctures; eyes slightly converging to the clypeus; area above the antennae slightly more opaque than the area below due to rather denser puncturation; postocellar line distinctly longer than the ocellocular line; the intraocellar line is much shorter than the ocellocular line; posterior orbits as broad as the cephalo-caudad diameter of the eyes; third and fourth antennal joints subequal; mesoscutum shining with distinct, well defined, well separated punctures; scutellum more sparsely punctured than the scutum; propodeum with sparse, poorly defined punctures; the basal area and areola confluent; the basal lateral areas sharply defined as is all the aerolation of the propodeum; first abdominal segment longer than the second, spiracles prominent; first tergite shining, almost impunctate. Black; apex of the mandibles piceous; abdomen beyond the first segment rufous; tegulae white; legs below the coxae rufous, the intermediate femora with a dusky streak above and the posterior femora black; posterior tibiae and tarsi with a dusky line above; wings hyaline; iridescent; venation black.

Genus CAMPOSCOPUS Förster.

Type.—*Camposcopus aclerivora,* new species.

CAMPOSCOPUS ACLERIVORA, new species.

This species runs to the genus *Camposcopus* in Förster's generic synopsis, very satisfactorily, and inasmuch as no species has heretofore been placed in that genus this may be considered as the type. The nervellus is broken very slightly below the middle.

Female.—Length 8 mm. Eyes large, inner margins broadly emarginate, strongly converging toward the clypeus; head shining, except the area between the ocelli and the bases of the antennae, almost impunctate; ocelli in a low triangle; postocellar line twice as long as the ocellocular line; third antennal joint one-third longer than the fourth; notauli well defined; prescutum with rather close, distinct punctures; the scutum more sparsely punctured; mesepisternum sculptured like the scutum, except the margin, which is striatopunctate; propodeum coarsely reticulate; on the posterior face the reticulations tend to transverse striations; on the dorsal aspect are two well defined carinae, the area between the carinae being transversely striate. Black; clypeus, mandibles, face above the dorsal margin of the antennae, scape beneath, cheeks, four anterior legs, and venter yellowish; flagellum beneath, tegulae, posterior legs except the dark apices of the tibiae, and the white four apical joints of the tarsi, first tergite, third and fourth tergites rufous; propodeum posteriorly rufo-piceous; wings hyaline, iridescent, venation pale brown, stigma testaceous.

Charter Oak, Pennsylvania. Described from one female recorded under Bureau of Entomology Number Hopk. U. S. 10910. This species is a parasite on *Acleris*, species, occurring on chestnut. It emerges from the pupa. Material collected, and reared March 11, 1913, by W. S. Fisher.

Type.—Cat. No. 18311, U.S.N.M.

Family BRACONIDAE.

Genus APANTELES Förster.

APANTELES (APANTELES) SIBINIDIS, new species.

Apparently is more closely allied to *tortricis* Ashmead, but the shape of the second dorsal segment and the character of the propodeum will readily separate it from that species.

Female.—Length 2 mm.; length of the antennae 1.5 mm. The upper margin of the clypeus well defined; a faint median carina below the antennae; face below the antennae opaque, with some well defined punctures, above the antennae shining, almost impunctate; transfacial line distinctly but not markedly longer than the facial line; postocellar line slightly shorter than the ocellocular line; intraocellar line subequal with the diameter of the anterior ocellus; antennae 18-jointed, the third joint subequal with the fourth; mesoscutum uniformly punctured, opaque, punctures well defined; suture between the scutum and scutellum finely foveolate; scutellum shining, with a few distinct punctures; propodeum with poorly defined costulae, the posterior face reticulate, the dorsal aspect with two subconvex, shining areas; plate of the first tergite with its length and width subequal, its apical width decidedly greater than the length of the second tergite; second tergite without a well-defined plate, the indefinitely defined plate rectangular in outline; suture between the second and third tergites well defined; the first three tergites longitudinally striato-reticulate, the sculpture becoming weaker at the apex of the third tergite; fourth and following tergites shining, impunctate; ovipositor extending but a short distance beyond the tip of the abdomen. Black; mandibles except the apices piceous; palpi pallid; tegulae dark brown; legs beyond the trochanters stramineous except a black spot on the dorsal apices of the posterior femora, the infuscate posterior tibiae and the two basal joints of the tarsi; wings hyaline, iridescent; costa and stigma pale brown, other venation pallid.

Male.—Length 1.5 mm.; length of the antennae 1.75 mm. Characters given for the female apply to this sex, except the posterior femora are infuscated and the sculpture of the first three tergites becomes more reticulate and is subobsolete laterally on the third; sides of the first tergite are dark in the male, while in the female they are pale.

Falls Church, Virginia. Described from three females and one male recorded under Bureau of Entomology Number Hopkins U. S. 11197*b*, material collected, and reared August 21, 1913, [illegible] Carl Heinrich, who records it as a parasite of *Sibine stimulea.*

Type.—Cat. No. 18502 U.S.N.M.

APANTELES (PROTAPANTELES) PHOBETRI, new species.

This species is related to *acronyctae* Riley, but the antennae are black, the face is more rugose, and it forms definite individual cocoons.

Female.—Length 2.5 mm.; length of the antennae about 3 mm. Clypeus not sharply differentiated from the face; face in the middle just below the antennae with rather large distinct punctures, with a defined median tubercle which becomes obsolete and broader toward the clypeus; head above the antennae shining, almost impunctate; the ocelli prominent; postocellar line subequal with the ocellocular line; intraocellar line greater by one-third than the width of the anterior ocellus; antennae 18-jointed; third joint slightly shorter than the fourth; third, fourth, and fifth joints constricted medianly indicating that in some specimens these joints may be partly divided; mesoscutum with large, distinct, separate punctures which become confluent in front of the scutellum; suture between the scutum and scutellum with four longitudinal rugae; scutellum shining, with a few large, shallow, poorly defined punctures; posterior face of the propodeum transversely rugulose dorsally, with two shining subconvex areas which are parted by a sculptured depression; laterally the posterior face is separated from the dorsal aspect by a rather well-defined carina; first tergite longer than its apical width, slightly broader apically; second tergite with the plate twice as wide as long; surface of the first two tergites striato-reticulate with a few punctures posteriorly; the suture between the second and third tergites well defined; the third and following tergites shining, impunctate. Black; palpi pale yellowish; legs ferruginous; tips of the posterior tibiae and their tarsi infuscated; wings hyaline, iridescent; costa and stigma pale brown, the rest of the venation ferruginous.

Falls Church, Virginia. Described from three females (one, type) recorded under Bureau of Entomology Number Hopk. U. S. 11197*d*, material collected, and reared September 28, 1913, by Carl Heinrich, who records it as a parasite of *Phobethron pithecium*.

Type.—Cat. No. 18501, U.S.N.M.

Genus GNAMPTODON Haliday.

GNAMPTODON NEPTICULAE, new species.

This species may be readily differentiated from the European genotype by the yellow markings of the abdomen and by the stronger second furrow of the tergites.

Female.—Length 1.5 mm. Face finely reticulate, posterior orbits shining; ocelli in a low triangle; the postocellar line slightly shorter than the ocellocular line; third antennal joint slightly longer than the fourth; entire thorax smooth, shining, practically impunctate; first tergite wider than long, surface opaque with fine lines; the basal area of the second tergite smooth, shining, impunctate; second area of the second tergite sculptured similar to the first tergite; the base of the third tergite with a complete foveolate suture which curves anteriorly; the suture between the second and third tergites finely foveolate; the third and following tergites shining, impunctate. Black; first four joints of the antennae, palpi, legs, first two tergites and apical three tergites, yellowish white; wings hyaline, stigma and basal venation pale brown, the venation beyond the stigma and basal vein pallid.

Male.—Length 1 mm. Differs, besides the usual sexual characters, from the above description of the female in having the basal joints of the antennae infuscated, the apical abdominal segments black and the posterior tarsi ducky.

Falls Church, Virginia. Described from one female and three males recorded under Bureau of Entomology Number Hopk. U. S. 11148*b*. Mr. Heinrich records this species as a primary parasite on *Nepticula castaneaefoliella* Clements. Material collected and reared by Carl Heinrich. Rearing dates as follows: Female, June 28, 1913; male allotype, August 19, 1913; male paratypes, June 30, 1913, and August 12, 1913

Type.—Cat. No. 18312, U.S.N.M.

Genus PHANEROTOMA Wesmael.

PHANEROTOMA LASPEYRESIA, new species.

This species is readily differentiated from other species of *Phanerotoma* by the black body and details in sculpture.

Male.—Length 5 mm. Clypeus sparsely punctured; supraclypeal foveae deep, punctiform, posterior orbits and occiput rather coarsely, somewhat irregularly continuously striate; head below the antennae with irregular transverse striae, just below the antennae the striae are continuous from base of one antenna to the base of the other antenna, forming a U-shaped area in which is a shining reticulate tubercle; head above the antennae transversely striato-reticulate; postocellar line subequal with the intraocellar line; malar space about half the diameter of the eye; antennae 23-jointed, the third joint distinctly but not much longer than the fourth; fourth, fifth, and sixth subequal, beyond that the joints gradually diminish until near the apex where the joints are subequal and sharply differentiated; mesoscutum opaque, finely granular; notauli well defined, foveolate, posteriorly reticulate; suture between the scutum and scutellum foveolate; scutellum more shining than the mesoscutum, sparsely punctured medianly, laterally with irregular striae; dorsal aspect of the propodeum coarsely reticulate with a rather poorly defined small V-shaped area in the dorsal middle; mesosternum shining, with sparse, well-defined punctures, ventrally [illegible]; prepectal suture foveolate; sides of the propodeum coarsely reticulate; first recurrent interstitial with the first transverse cubitus; abdomen coarsely longitudinally striato-reticulate; first tergite with two striae predominating which converge until they approtimate near the posterior margin; the false sutures strongly foveolate; third tergite with the striato-reticulations finer posteriorly and becoming concentric; the apical margin of the tergites finely serrate. Black; scape beneath, and legs except the piceous apices of the posterior tibiae and the brownish posterior tarsi, brownish ferruginous; wings hyaline, very slightly dusky, venation dark brown.

Kyburz Station, Eldorado County, California. Described from two males recorded under Bureau of Entomology Number Hopk. U. S. 11477*d*, which refers to a note stating that this species is parasitic in the larval galleries of *Laspeyresia toreuta*, material collected and reared by J. M. Miller.

Type.—Cat. No. 18418, U.S.N.M.

Genus BASSUS Fabricius.

BASSUS COLEOPHORAE, new species.

Judging from the description, this species is related to *Bassus* (*Microdus*) *annulipes* Cresson, but the black hind femora will serve to separate it from that species.

Female.—Length 2 mm. Anterior margin of the clypeus slightly, arcuately emarginate; supraclypeal foveae deep, punctiform; face shining with a few scattered setigerous punctures; head above the antennae and posterior orbits shining without setigerous punctures; area around the anterior ocellus raised; postocellar line slightly longer than the ocellocular line; third and fourth joints of the antennae subequal; mesoscutum shining with scattered fine, setigerous punctures; notauli well defined and when magnified 35 diameters, finely foveolate; suture between the scutum and scutellum with three rugae; scutellum shining; dorsal aspect of the propodeum irregularly reticulate on a granular surface; mesepisternum shining, impunctate; sternauli well defined, finely foveolate; first tergite one-fifth longer than its apical width, opaque, finely granular; second and following tergites shining, impunctate; ovipositor almost as long as head and thorax, densely pilose. Black; labrum, mandibles, palpi, ligulae, and four anterior legs below the coxae fulvous; the apex of the intermediate tibiae and a spot at the base and their tarsi dusky; posterior trochanters fulvous; posterior tibiae with a narrow annulation at base and a broader one at the middle, white; base of the posterior tarsi with a white spot; calcaria white; wings hyaline; venation pale brown, the costa slightly darker; pubescence sparse and gray.

Charter Oak, Pennsylvania. Described from two females (one, type), recorded under Bureau of Entomology No. Hopk. U. S. 11135*a*, which refers to a note stating that this species is parasitic on *Coleophora leucochrysella* Clemens, feeding on chestnut. Material reared by Carl Heinrich, adults issuing June 3, 1913.

Type.—Cat. No. 18181, U.S.N.M.

Genus MICROBRACON Ashmead.

MICROBRACON COLEOPHORAE, new species.

Resembles *Microbracon furtiosus* (Fyles) but readily separated by details in puncturation and color.

Female.—Length 2.5 mm. Face shining; eyes very slightly converging to the mandibles; vertex and occiput shining; postocellar line slightly longer than the diameter of one of the lateral ocelli; inner supraorbital area finely punctured; antennae 29-jointed, the third and fourth joints subequal; mesoscutum shining; notauli with setigerous punctures along their border; suture between the scutum and the scutellum finely, regularly foveolate; propodeum shining, impunctate; first tergite with the area defined by the lateral carinae rectangular in outline, slightly longer than the apical width; the triangular shaped area of the first tergite is well defined and practically the length of the entire segment; first tergite with the lateral areas irregularly sculptured, the median triangularly shaped area with fine, scattered punctures; second tergite with the basal median area rugose, the remaining part of the segment finely granular; the following tergites shining, impunctate, except for the setigerous punctures under a magnification of 35 diameters. Black; mandibles, inner orbits, spot on the mesoscutum posteriorly, sides of the pronotum, dorsally, abdomen except the rectangular area of the first tergite, and small spots on the third, fourth and fifth tergites rufo-ferruginous; legs rufo-ferruginous except the apical joints on the four anterior tarsi, the apical third of the posterior tibiae and their tarsi, which are black; wings faintly dusky; venation pale brown, stigma [illegible] costa darker brown; entire body and legs covered with fine white hair which is especially dense on the posterior tibiae and tarsi.

Male.—Length 2 mm. Agrees in general with the female except the head and the thorax are entirely black; the abdomen except the second tergite is black; the four anterior femora, the base [illegible] most of their tibiae and tarsi are dusky.

Falls Church, Virginia. Described from one female (type) and one male (allotype) recorded under Bureau of Entomology No. Hopk. U. S. 11135*b* which refers to a note stating that this species [illegible] parasitic on *Coleophora leucochrysella* Clemens feeding on chestnut. Material collected and reared by Carl Heinrich, adults emerging June 7, 1913.

Type.—Cat. No. 18180, U.S.N.M.

MICROBRACON HEMIMENAE, new species.

The color and sculpture of the abdomen readily distinguish this species from any other species which has been placed in this genus.

Female.—Length 3 mm. Clypeus defined above by transverse furrow which connects laterally with two small punctiform areas; the face finely granular, vertex, posterior orbits and occiput polished, impunctate; postocellar line about half as long as the ocellocular line; antennae 26-jointed, first three joints of the flagellum subequal; mesoscutum impunctate, polished; the suture between the scutum and scutellum finely, regularly foveolate; scutellum shining, impunctate; propodeum shining, impunctate and without a median carina or furrow; mesepisternum highly polished, impunctate; first tergite with the length and width of the plate nearly subequal; the median triangular area shining and not as densely sculptured as the lateral areas, the furrows foveolate; second tergite uniformly coarsely irregularly reticulate on a granular surface, apical margin shining; third, fourth, and base of the fifth tergite with distinct, uniform granulation, which becomes sparser and less defined towards the apex of the abdomen; ovipositor about two-thirds the length of the abdomen. Black; abdomen except the first tergite and a small median spot on the second, rufo-ferruginous; legs black; the four anterior femora beneath and the apical two-thirds of the posterior femora rufo-piceous; wings dusky, venation dusky brown; apical joints of the posterior tarsi subequal in length with the second.

Paratypes indicate that the black spot on the second tergite may be wanting.

Plummers Island, Maryland. Described from three females reared by Mr. August Busck from *Hemimenae plummerana* Busck which feeds on the flowers of pawpaw, specimens issuing May 21, 1914.

Type.—Cat. No. 18434, U.S.N.M.

Family BETHYLIDIDAE.

Genus TRISSOMALUS Keiffer.

TRISSOMALUS FULVICORNIS, new species.

Female.—Length 4 mm. Mandibles tridentate, the two apical teeth large; supraclypeal area with a sharp median carina; head polished, with a few widely separated punctures; third and fourth antennal joints subequal; ocelli in an equilateral triangle; postocellar line about half as long as ocellocular line; thorax shiny; dorsal aspect of the propodeum finely aciculate; the median furrow deep, not quite reaching to the apex; the carina separating the dorsal aspect from the posterior aspect, notched in the middle; posterior aspect of the propodeum transversely irregularly striate; abdomen shiny, the second and third segments subequal in length. Black; palpi, antennae, tibiae and tarsi fulvous; wings hyaline, iridescent; venation except the brown stigma and parastigma, yellowish; head and thorax with a few white hairs.

[illegible]halli, Mysore, India. Described from eight specimens labelled as bred from *Cryptophlebia carpophaga*, November 14, 1911. Received from [illegible] C. Coleman.

Type.—Cat. No. 1675, U.S.N.M.

Family THYNNIDAE.

Genus DOLICHOTHYNNUS Turner.

DOLICHOTHYNNUS SILVICOLA (Bradley).

Ornepetes silvicola BRADLEY, Deutsch. Ent. Zeit., 1911, p. 131.

Paratype.—Cat. No. 14507, U.S.N.M.

Doctor Bradley has kindly sent the Museum a paratype of this interesting species. On examination it proves to belong to the genus *Dolichothynnus* Turner.

Family SCOLIIDAE.

Genus ELIS Fabricius.

ELIS XANTHONOTUS, new species.

Readily distinguished by its black color and yellow mesoscutum.

Female.—Length 14 mm. Clypeus with large confluent punctures, anterior margin nearly truncate, supraclypeal suture strong; antennal foveae rather sharply defined, smooth, impunctate; front with deep, confluent punctures; following the inner margin of the eye [illegible] a low, rounded carina; head above the supraorbital line and posterior orbits polished with a few widely scattered punctures; ocelli in a low triangle, each ocellus situated in a pit, that of the anterior one larger and extending below the ocellus a short distance; postocellar line about one-third longer than the ocelloccipital line; third antennal joint slightly shorter than the fourth; antennae with the joints serrate beneath; anterior face of the pronotum longitudinally striate below; pronotum anteriorly and laterally with large nearly confluent punctures, the rest of the surface shining with small scattered punctures; mesoscutum polished practically impunctate, longitudinal impressed lines strong; scutellum polished with a few scattered punctures; sides of the pronotum with four strong, oblique rugae and a number of fine oblique striae; mesepisternum shining with large, separated, well-defined punctures; dorsal aspect of the propodeum finely granular, a median area with a few large, separated punctures, posterior face of the propodeum separated from the dorsal aspect by three strong transverse (arcuate in the middle) rugæ, posterior face of the propodeum shining with a few poorly defined striae lat erally, sharply separated in the sides; side of the propodeum strongly, obliquely, striate posteriorly; legs normal but rather more robust than usual; second cubital cell on the radius slightly longer than the third, the first recurrent vein received slightly behind the middle of the second cubital cell; the second cubital vein received slightly basad of the middle of the third cubital cell; transverse median of the fore wings slightly behind the basal vein; abdomen shining, segments with a few fine, little separated punctures; pygidium notched apically, the surface longitudinally striato-granular; hypopygidium sharply curved apically. Black; mesoscutum inside of the first longitudinal furrow yellow; insect clothed with long glistening hair; wings hyaline, dusky; venation pale brown.

Rio Piedras, Porto Rico. Described from one female collected February 1, 1912, by T. H. Jones and given the accession number 113-1912, "P.R.S.G.A."

Type.—Cat. No. 15243, U.S.N.M.

Genus CAMPSOMERIS Lepeletier.

CAMPSOMERIS (CAMPSOMERIS) PYRURA, new species.

This may be only a race of *Campsomeris fulvohirta* Cresson, but compared with the original description the following differences are to be noted: Female—no yellow spots on the pronotum; polished disk on the mesonotum not divided by a punctured line; the femora red; the first dorsal segment with a continuous band; male—scape rufous; femora red; second and third abdominal segments not divided or indented in the middle.

Female.—Length 15 mm. Clypeus longitudinally irregular, striato-punctate in the middle, laterally with distinct, separated punctures, front closely punctured, divided by an impunctate raised area which is impressed in the middle; vertex and posterior orbits polished with a few widely separated punctures; ocelli in a low triangle; the postocellar line about twice as long as intraocellar line; latrad and caudad of each lateral ocellus is a punctiform fovea; the flagellum thickening apically; the apical joint about as long as the two preceding on the outer margin, truncate apically, the first joint slightly longer than the second; pronotum and most of the mesonotum with large, close punctures; disk of the mesonotum not divided by a punctate line; scutellum with a few large, well separated punctures laterally, the median area impunctate; posterior margin and sides of metanotum impunctate; dorsal aspect of the propodeum with rather large, close punctures basally, apically very finely punctured; posterior face impunctate, shiny, higher in the middle; the abdomen very finely granular with a few large punctures, the apical segments with close, nearly confluent punctures; pygidium broadly rounded apically. Black; mandibles and scape piceous; a broad band on the first dorsal segment, a band on the second and third dorsal segments narrowed laterally and indented medianly; a narrow band on the second ventral segment and elongate spots on the third ventral segment yellow; head, somewhat densely so in the front, pronotum, mesonotum, and the apical four dorsal segments with long red hairs; the femora and the venter, sides of the thorax with long yellowish hair; sides of the propodeum with short appressed yellowish pubescence; legs below the trochanters rufous; wings yellowish hyaline, yellow more prominent along the costa, apical margin of the wings with a dusky tinge which is faintly bluish in some lights; venation rufous.

Male.—Length 12 mm. Anterior margin of the clypeus gently rounded, front up to the upper margin of the emargination of the eyes closely, finely punctured; between the antennae a faint raised tubercle, the vertex sparsely punctured; postocellar line longer than the ocellocular line; anterior ocellus much larger than the lateral ocelli; antennae fulviform reaching almost to the apical margin of the first tergite, the third and fourth joints subequal; pronotum and mesonotum shiny with a few fine punctures; dorsal aspect of the propodeum as in the female; first abdominal segment much longer than the second which is subequal in length with the third; the basal four abdominal segments above with a few fine punctures, the apical segments with a number of large punctures; apical margin of the pygidium broadly rounded with the usual median notch. Black; base of mandibles, labrum, clypeus, dorsal margin, and a spot on the side of the pronotum, spot on the tegula, a spot just inside the tegula, two spots on the scutellum, a band on the mesonotum, broad band on the first three dorsal segments (on the third the band is rather broader in the middle where it is slightly emarginate), narrow apical margin of the third dorsal segment, apical margin of the second, third, and fourth ventral segments (the second ventral segment has the band broader in the middle) yellow; the scape, legs below the trochanters and three apical abdominal segments rufous; wings color of the female; covered with pubescence as in the female with the exception that that on the thorax to the basal part of the abdomen is reddish yellow.

Mayaguez, Porto Rico. Described from two females (one type) and one male allotype collected by C. W. Hooker.

Type.—Cat. No. 15078, U.S.N.M.

Family PSAMMOCHARIDAE.

Genus CEROPALES Latreille.

CEROPALES STRETCHII Fox.

Ceropales stretchii Fox, Trans. Amer. Ent. Soc., vol. 19, 1892, p. 52. Female.

Ceropales fraterna, var. *occidentalis* Cockerell, Ann. Mag. Nat. Hist., ser. 7, vol. 2, 1898, p. 455. Male.

The type of *Ceropales fraterna*, var. *occidentalis* Cockerell (Cat. No. 15364, U.S.N.M.) is the undescribed male of *C. stretchii* Fox and is closely allied to *fraterna* but may be distinguished from it by the yellow band on the first tergite.

CEROPALES NEOMEXICANA, new species.

Related to *albopicta* Cresson, but may be distinguished by the almost entirely black four anterior femora.

Male.—Length, 8 mm. Antennae as long as the head and thorax together. Anterior margin of the clypeus truncate; head shining, front with a few widely scattered punctures; frontal impressed line faint, poorly defined; postocellar line one-fourth shorter than the ocellocular line; pronotum shining, impunctate; scutum shining, the middle with large separate punctures; scutellum practically impunctate as is also the metanotum; mesepisternum opaque with large, well defined, widely separated punctures; sides and the dorsal aspect of the propodeum shining, practically impunctate, posterior face transversely striato-reticulate, with a strong median furrow extending a short distance down the posterior face; legs normal; second cubital cell about twice as long on the cubitus as its greatest width; abdomen subopaque. Black; head below the antennae, the inner eye margins broadly, two spots on the posterior orbits, scape and pedicel beneath, posterior margin of the pronotum, shoulders, tegulae, spot on the scutellum, spot on the metanotum, apical lateral margin of the propodeum, spot on the coxae beneath, spot on the apices of the four anterior femora beneath, four anterior tibiae beneath, anterior tarsi and the base of the intermediate tarsi, spots on the sides of the first tergite and a band on the second and following tergites yellowish [illegible] four posterior legs rufous, piceous at the apices of the tarsi; wings hyaline, iridescent; venation and stigma pale brown.

[illegible] New Mexico. Described from one male.

Type.—Cat. No. 15363, U.S.N.M.

Genus BATAZONUS Ashmead.

This genus may be divided into two groups by the salient character habitus. The typical group *Batazonus* has only the type species. The other group, *Pycnopompilus*, has a number of closely allied species which are subject to much variation in color. The character Mr. Banks uses to separate *Batazonus* and allies from *Psammochares* seems with the addition of one of the following new species to be subject to slight variation. As a substitute for this character it might be well to use the depressed abdomen in *Batazonus* which has the cross section triangular and not cylindrical as in *Psammochares* and *Arachnophroctonus*. The following table will serve to separate the species of the group *Pycnopompilus* into two categories.

Clypeus truncate .... *interruptus* (Say).
navus (Cresson).
gundlachii (Cresson).

Anterior margin of clypeus slightly emarginate .... 1.

1. Front with two nearly parallel yellow lines; "antennae bright yellow"; (legs yellow with most of four posterior femora black) .... *mundus* (Cresson).
Front with a single median yellow line (the yellow of inner orbits excepted); antennae dark apically .... 2.

2. Femora rufous; yellow band of the second tergite broader laterally; postocellar line slightly longer than the ocellocular line .... *mundiformis*, new species.
Femora mostly black; yellow band of the second tergite nearly uniform in width; postocellar line slightly shorter than the ocellocular line... *hookeri*, new species.

BATAZONUS HOOKERI, new species.

Female.—Length 8.5 mm. Slender. Anterior margin of the clypeus slightly incurved, along the apical margin a number of distinct, well separated punctures, the front viewed from the side rounded; vertex nearly flat; ocelli small; postocellar line slightly shorter than the ocellocular line; antennae slender, the third joint but little shorter than the fourth and fifth; posterior margin of the pronotum without a median impressed line, posterior margin broadly arcuate; legs rather feebly spined, the longer spur of the posterior tibia but little shorter than the post-basitarsus; claws with an erect inner tooth; the sternites emarginate on the apical margin, the emargination on the fourth deeper and subtriangular, the others broadly, arcuately emarginate; third cubital cell shorter on the radius than the second, the distance between the second and third transverse cubiti subequal in length with the distance between the second transverse cubitus and the second recurrent vein; transverse median on the hind wings about three times the width of the vein beyond the cubitus. Black; antennae beneath and the third, fourth, and fifth joints above rufo-ferruginous; clypeus except a large median spot, which is broader basally and narrowed to the truncate apex, inner orbits more broadly below, single line from the anterior ocellus to between the bases of the antennae, a narrow line on the posterior orbits which nearly meets the occiput, narrow posterior margin of the pronotum, small spot on the sides of the pronotum, two parallel lines on the mesonotum which are confluent posteriorly, spots on the side of the scutellum, metanotum, two other elongate spots on the mesepisternum basally, margin of the metepimeron, two spots on the posterior face of the propodeum basally, abdominal segments above and below, narrow bands on the basal margin of the second, third, and fourth tergites and most of the fifth tergite yellow; legs black, the anterior coxae beneath, small spot sides of the intermediate coxae yellow; apices of the femora (more broadly on the four anterior ones) tibiae and tarsi rufo-ferruginous; calcaria pallid; wings yellowish hyaline, the apices dusky; venation yellowish basally, apically pale brown.

Mayaguez, Porto Rico. Two females, one collected January 27 (type) the other January 25, 1912, by C. W. Hooker, for whom this species is named.

Type.—Cat. No. 15079, U.S.N.M.

BATAZONUS MUNDIFORMIS, new species.

Female.—Length 10 mm. Anterior margin of the clypeus gently emarginate, the apex granular with a few large punctures; front viewed from the side very slightly rounded; vertex viewed from in front flat; anterior ocellus slightly larger than the lateral ocelli; postocellar line slightly longer than the ocellocular line; antennae slender, the third joint about one-third longer than the fourth; posterior margin of the pronotum with the normal line-like depression; posterior margin of the pronotum subtriangularly, emarginate;

venation nearly as in *hookeri;* emargination of the sternites as in *hookeri.* Black, variegated with yellow and ferruginous; clypeus except transverse spot basally, inner orbits (broader below), a line from the median ocellus between the bases of the antennae, narrow posterior orbits almost meeting on the occiput, spot on the anterior margin [illegible] the pronotum, spot on the sides of the pronotum, posterior margin [illegible] the pronotum broadly, tegula except the fuscous margins, two narrow lines on the mesonotum which converge posteriorly to form a [illegible] spots on the scutellum, metanotum, two large spots on the mesosternum, spots on the metapleurae just below the wings, posterior face of the propodeum, the dorsal aspect of the propodeum except in the middle, posterior margin of the metaepimeron, two basal segments above and below at base and the basal margin of the third tergite yellow; legs ferruginous, coxae black, the four anterior ones yellow beneath, the four posterior ones with a yellow spot on the posterior margin, tarsi yellow, the bases of the joints ferruginous; abdomen except where mentioned rufo-ferruginous; antennae rufo-ferruginous to the sixth joint beyond which they are dark brown; head and thorax except where mentioned black; wings yellowish when viewed in certain lights with a strong bluish tinge; venation yellowish to pale brown.

Male.—Length 6.5 mm. Agrees very well with the above description of the female, but has the colors of the abdomen more sharply contrasted, the clpyeus without black spot, the yellow on the posterior orbits and that on the propodeum is broader, the bases of the four posterior femora black. Third antennal joint is distinctly shorter than the fourth.

Described from three females and two males collected in the West Indies. The type female was collected at Bonwood Valley near Kingston, Jamaica, October 21, at an altitude of eight hundred feet on "second growth." The allotype male was collected near Mount Gay Leeward, Jamaica (?), September 23, at an altitude of three hundred feet in an open space on herbage. One female collected on Windward side of St. Vincent by H. H. Smith. The other specimens bore no definite locality.

Type.—Cat. No. 15080, U.S.N.M.

This is the species recorded from the West Indies by Ashmead as *Pycnopompilus mavus.*

Family EUMENIDAE.

Genus ODYNERUS Latreille.

Subgenus STENODYNERUS Saussure.

Group PRECAMPANULATI.

Clypeus much longer than wide, apex truncate; head with separate distinct punctures; inside of lateral ocelli with a tubercule, much stronger in male; anterior margin of pronotum with [illegible] carina, angles subdentate; thorax with separate punctures; meso-scuto-scutellar sutures foveolate; scutellum with a median longitudinal furrow; metanotum narrow, raised, emarginate in middle; apical margin of the second dorsal strongly reflexed; suture of second ventral strongly foveolate; base of second ventral with a median sulcus; posterior coxae with a spine. Mostly rufo-ferruginous; wings strongly dusky.

Odynerus sulciventris Cameron and *O. congressensis* Cameron, judging from the descriptions are similar in color, but the metanotum is quite different. The species of this group may be separated by the following table:

Head black and yellow; mesoscutum black; anterior ocellus hooded; [illegible] dorsal slightly reflexed, male.................................*precampanulatus* Viereck.
Head rufo-ferruginous or with some black; mesoscutum mostly ferruginous; anterior ocellus not hooded; third dorsal segment not reflexed, female.................. 1.
1. No depression behind ocelli; front and posterior orbits with rather close distinct punctures (second dorsal with free yellow spot)..................*blawus* Rohwer.
A shallow depression behind ocelli; head with poorly defined widely separated punctures...*odontoschius* Rohwer.

ODYNERUS (STENODYNERUS) PRECAMPANULATUS Viereck.

One male which agrees very well with the original description of this species was collected May 5, 1910, at Albuquerque, New Mexico, by J. R. Watson.

ODYNERUS (STENODYNERUS) BLAWUS, new species.

This may be the female of *precampanulatus*, but the head is more strongly punctured, and there is a free yellow spot on the second dorsal segment, as well as some other characters.

Female.—Length to apex of second dorsal 7.5 mm. Clypeus striatopunctate; punctures of the head rather large and not separated from each other by more than twice the width of a puncture; first joint of the flagellum slightly longer than the second; mesothorax punctured like the head; lateral aspect of propodeum finely striatopunctate; metanotum not serrate; abdomen punctured similar to head. Rufo-ferruginous; flagellum above, antennal foveae, rectangular spot inclosing ocelli, spot on anterior mesoscutum, sutures of mesothorax and prepectus black; small spot at eye emargination, two small spots on middle of pronotum, band on first, second, and third dorsal segments and a small spot on second dorsal yellow. Wings irridescent, venation black.

Albuquerque, New Mexico. One female collected May 5, 1910, by J. R. Watson.

Type.—Cat. No. 14306 U.S.N.M.

ODYNERUS (STENODYNERUS) ODONTOSCHIUS, new species.

Female.—Length to apex of second dorsal segment 7 mm. Clypeus striato-punctate; head with small, well scattered punctures, which are separated from each other by three to five times the width of the punctures (below the emargination of the eye the punctures are larger and better defined); first joint of the flagellum about one-third longer than the second; mesothorax with large, close punctures, more widely separated on the posterior part of scutum; metapleurae and anterior part of latro-propodeum finely striate; posterior part of the sides of the propodeum with nearly confluent punctures; abdomen closely punctured. Rufo-ferruginous; flagellum above, a spot (narrowed posteriorly and emarginate medially anteriorly) enclosing ocelli, spot on anterior mesoscutum, prepectus, sutures of metathorax and a spot at base of second dorsal segment black; apical margins of the first and second dorsal segments broadly yellow; costa and stigma testaceous, venation pale brown.

Paratype differs in having small yellow spots at the emargination of eye and two spots on middle of pronotum.

Las Cruces, New Mexico. Two females, the type, "Ckll. 5091."

Type.—Cat. No. 14307, U.S.N.M.

ODYNERUS (STENODYNERUS) ODONTOSCHIUS, var. DICHROUS, new variety.

Female.—Length to apex of second dorsal segment 7 mm. Differs from the typical form in the absence of black markings and in the presence of a yellow spot below the tegulae, four yellow spots on second dorsal and a yellow band on the third dorsal segment.

Las Cruces, New Mexico. One female collected October 5, 1895, by Prof. T. D. A. Cockerell.

Type.—Cat. No. 14308, U.S.N.M.

ODYNERUS (STENODYNERUS) ANACARDIVORA, new species.

Related to *Odynerus* (*Stenodynerus*) *australis* Robertson but may be separated from that species by having the anterior face of the first tergite sculptured, by the more sharply dentate clypeus and in being general more coarsely punctured.

Female.—Length 11 mm. Clypeus slightly longer than wide, the anterior margin dentate, the teeth broad and obtusely truncate, the surface coarsely striato-punctate with a carina running down each tooth; frontal carina flattened and with a median fovea; head coarsely, distinctly punctured, no tubercule behind the lateral ocelli; postocellar line distinctly longer than the ocellocular line; antennae thickened apically, the third joint about one-half longer than the fourth; pronotum punctured similarly to the vertex; the lateral anterior angles not dentate; mesoscutum and scutellum punctured similarly to the pronotum; the scutum with faintly indicated notauli posteriorly; the metanotum with widely separated punctures; mesepisternum more sparcely punctured than the mesoscutum; propodeum coarsely, closely punctured, almost reticulate without ridges or elevations; first tergite very coarsely punctured anteriorly so as to be almost reticulate, posteriorly the punctures are more separated; the second tergite with distinct, well defined punctures basally and apically; the median area with setigerous punctures only; second sternite with sparse, well defined punctures; the suture between the first and second sternites strongly foveolate; legs [illegible] black; clypeus, frontal carina, a clot at the emargination of the eyes, a spot on the superior posterior orbits, the anterior median area of the pronotum, tegulae, spot below, metanotum, propodeum, first segment, narrow apical margin of the second tergite, dark rufous; legs except the anterior coxae dark rufous; antennae rufous to the sixth joint, beyond that, brown; wings dark smoky; venation black.

Miami, Florida. Described from one female collected August 13, 1913, by E. R. Sasscer and recorded as feeding on *Anacardium excelsum*

Type.—Cat. No. 16853, U.S.N.M.

Subgenus ODYNERUS sensu stricto.

ODYNERUS MARGARETELLUS, new species.

This species can be readily separated from all other American species by the bright red second tergite, legs, and dense black hair on the body. In structure it is also different from many of the American species as the following description will show.

Female.—Length 8 mm. Clypeus wider than long, gently evenly convex, the anterior margin produced into a broad tooth which is deeply emarginate, the lobes being obtusely pointed and well defined, the surface with sparse, well-defined punctures which are smaller medianly than apically; the head below the supraorbital line with close, distinct punctures which around the antennæ become confluent; vertex and posterior orbits shining, with sparse, well-defined punctures; postocellar line subequal with the ocellocular line; flagellum short, thickening apically, the third joint distinctly longer than the fourth and fifth which are narrower basally; pronotum with close rather small punctures; mesoscutum more sparsely punctured; punctures denser laterally; notauli well defined, extending to the base of the scutellum, diverging from the anterior third; suture between the scutellum and scutum finely foveolate; scutellum shining, more densely punctured posteriorly, parted by a faint median furrow; metanotum sloping, opaque, finely granular with a few large, irregular punctures; propodeum sculptured similar to the metanotum, without a concave area and without ridges or teeth; abdomen shining, when highly magnified the apical segments are finely granular; first tergite about four times as wide as long; the second tergite one and one-third times as wide as long, the third tergite retracted; pygidium poorly defined. Black; palpi and mouth parts brown; band on the posterior margin of the first tergite, the second segment except a rectangular spot on the basal middle of the sternite and tergite, legs beyond the apical third of the femora, bright red (this color is not due to cyanide); body densely clothed with black hairs, those on the second tergite becoming shorter and less black; wings dusky hyaline; venation black.

Male.—Length 8 mm. Clypeus yellowish white except the apical margin which is piceous, surface with appressed, glistening white hairs with a few large erect hairs interspread; second sternite without a black spot; wings slightly paler than in the female. Otherwise the characters given for the opposite sex apply well to this sex.

Troublesome, Colorado. Described from one female (type) and two males (one allotype) collected at an altitude of 7,345 feet, June 8, 1908, by S. A. Rohwer.

Type.—Cat. No. 18526, U.S.N.M.

Family SPHECIDAE.

Genus DIODONTUS Curtis (not Auctorum).

Neofoxia VIERECK.
Diodontus CURTIS, Brit. Ent., vol. 11, 1834, p. 496.

Type.—*Psen pallipes* Panzer (Original designation).

Neofoxia VIERECK, Trans. Amer. Ent. Soc., vol. 27, 1901, p. 338.

Type.—*Psen atrata* Panzer (Original designation).

According to the published synonymy *Psen pallipes* Panzer and *Psen atrata* Panzer are the same. Therefore by synonymy *Neofoxia* Viereck becomes isogenotypic with *Diodontus* Curtis (not Auctorum).

Genus XYLOCELIA, new genus.

Diodontus SHUCKARD and of Authors.

When Curtis originally founded his genus *Diodontus* he stated that the type was *Psen pallipes* Panzer. In 1837, having discovered his error, he wrote that what he figured as *Diodontus pallipes* (Panzer) was *Pemphredon tristis* Van de Linden and therefore seems to consider Van de Linden's species as the type of *Diodontus*. This he had no right to do, because, "When in the original publication of a genus, one of the species is definitely designated as type, this species shall be accepted as type regardless of any other consideration."[1] Curtis definitely said "type of the genus, *Psen pallipes* Panzer." He did *not* say, type of the genus *Psen pallipes* Panzer as determined by me; therefore *Psen pallipes* Panzer (not Curtis) must be the type of *Diodontus*. This is unfortunate as *Diodontus* will apply to the group of insects known as *Neofoxia* and belong to *Pseninae*. The *Diodontus* of Shuckard and authors is without a name, and may be called *Xylocelia*. The type of *Xylocelia* is *Diodontus occidentalis* Fox.

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[1] Science, n. s., vol. 26, No. 668, Oct. 18, 1907. See also opinion 65 of International Commission on Zoological Nomenclature.

Genus PSEN Latreille.

PSEN (MIMESA) MODESTA, new species.

Male.—Length 6 mm. Anterior margin of the clypeus [illegible]ntate; frontal carina complete from the anterior ocellus to between the bases of the antennae, not strongly raised; front coarsely striato-punctate; vertex shiny, finely punctured; ocelli nearly an equilateral triangle; the postocellar line much shorter than the ocellocular line; antennae very slightly thickened apically, densely clothed with pale pile, the third joint much longer than the fourth; mesonotum coarsely striato-punctate in the middle, anteriorly the striae are more prominent, laterally sparsely punctured; scutellum shiny, sparsely punctured; propodeum with triangular-shaped basal depression, coarsely punctured, the sides and posterior face coarsely reticulate; petiole long, almost as long as to the apex of the hind femora, when the hind legs are stretched longitudinally; petiole trisulcate dorsally, unisulcate laterally; abdomen shiny, practically impunctate. Black; cheeks, face below the antennae, pleura and propodeum densely clothed with silvery pile; tarsi pallid; wings dusky hyaline, iridescent; venation dark brown.

Mayaguez, Porto Rico. Described from three males. No collector given.

Type.—Cat. No. 15081, U.S.N.M.

Genus AMMOBIA Billberg.

AMMOBIA SPINIGER (Kohl).

A male of this species was collected by W. Büther in the Blue Mountains, vicinity of Gordon Town, Jamaica.

Genus LARROPSIS Patton.

LARROPSIS GRACILIS, new species.

Related to *conferta* (Fox), but may be distinguished from that species by the greater distance between the eyes at the vertex and yellowish wings.

Female.—Length 10 mm. Anterior margin of the clypeus rounded, indistinctly dentate laterally; head with distinct, separated punctures, which are more widely separated along the median line; space between the eyes at the top slightly greater than the length of the second, third, and fourth antennal joints; first joint of flagellum distinctly shorter than the second; dorsal margin of pronotum with a median notch; mesothorax with fine, distinct, close punctures; scutellum not impressed; dorsal surface of propodeum with a raised area which is pointed [illegible]iorly, with transverse fine striae, and a median longitudinal [illegible]w; sides of propodeum finely punctured; third cubital cell lo[illegible] the radius than second; pygidium about twice as long as the [illegible] width, rounded apically, with a few scattered punctures. Black; tegulae and tarsi rufo-testaceous; first three abdominal segments orange color; wings hyaline, yellowish; venation yellow.

Male.—Length 8 mm. What may be the male differs from the description of the male of *conferta* as follows: space between the eyes at vertex greater than the second, third, and fourth antennal joints; scutellum not impressed. Differs from the female in the hyaline wings, slightly darker venation and in being rather more coarsely sculptured.

Denver, Colorado. One female collected August 1 (type). One male from C. F. Baker Collection, Colorado.

Type.—Cat. No. 14409, U.S.N.M.

LARROPSIS DOLOSANA, new species.

Superficially like *vegata* (Fox), but is very distinct from that species. In Fox's table it runs to *dolosa* (Fox), from which it may be separated as follows: Length 13.5 mm.; abdomen black; striæ of the posterior face stronger than those of the sides of the propodeum; a narrow area on each side of the frontal line sparsely punctured; tarsi black. Female.

Go[illegible], Washington. One female collected by J. A. Hyslop, Aug[illegible] 1911. Carrying a female Orthopteran belonging to the genus *[illegible]cnemis*.

Type.—14408, U.S.N.M.

Genus PIAGETIA Ritsema.

Dicranorhina Shuckard 1840 not Hope 1837.

Turner[1] states that *Dicranorhina* Shuckard should replace Piagetia Ritsema (1872) because *Dicranorhina* Hope 1837 was emended to *Dicranorrhina*. This is not in accord with International Code of Zoological Nomenclature. The emendation of *Dicranorhina* Hope will rank as a synonym of the same genus, and *Dicranorhina* Shuckard being preoccupied, can not replace *Piagetia* Ritsema.

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[1] Ann. Mag. Nat. Hist., ser. 8, vol. 9, 1912, p. 199.

Genus PISON Jurine.

PISON AUREOSERICEUM, new species.

This may be a dark form of *Pison peletieri* Le Guill[illegible]but as all of the specimens have the second dorsal mostly black a[illegible]Guillon's description is very short, it is impossible to say with ce[illegible]y. The following points will serve to separate this species [illegible]*virosum* Turner: Space between antennae subequal with sp[illegible]between antenna and eye; postocellar and ocellocular lines equal; [illegible]median sulcus on the front; larger; etc. *P. aureosericeum* m[illegible]long to the same group as *marginatum* Smith and *auriventra* T[illegible]but it does not agree with the descriptions of either of these, [illegible]*Pison aurifex* Smith, to which *aureosericeum* seems to be [illegible]ed, it may be separated by the facial pubescence extending to the vertex; the femora and trochanters entirely ferruginous; and first dorsal segment is nearly all ferruginous.

Female.—Length 11 mm. Clypeus about twice as wide as long, apex truncate, sides hardly angled; distance between antennae at base subequal with the distance between an antenna and eye; no median frontal sulcus; the distance between the eyes at clypeus not quite twice as great as at distance between them at the vertex; emargination of eyes not quite twice as deep as the length of pedicellum; third antennal joint distinctly longer than the fourth; ocelli in an acute triangle; postocellar and ocellocular lin[illegible]equal; head with fine, distinct punctures, which are quite close on the front; pronotum rounded, but little below the top of mesono[illegible]mesonotum with the punctures larger and more separate than those of the head; dorsal aspect of the propodeum with a strong median sulcus in which there is a carina, and obliquely striato-punctate; posterior face of the propodeum strongly, transversely striate, and with a partial median sulcus; abdomen finely punctured, first and second dorsal segments feebly depressed apically, and the second slightly constricted basally; recurrent veins and transverse cubiti interstitial; petiole and second cubital cell subequal in height; third cubital about twice as long on the cubitus; transverse median distinctly beyond the basal. Black; mandibles, palpi, three basal joints of antennae, tegulae, legs below coxae, first dorsal segment except a spot at base and apical margins of the following segments ferruginous; insect abundantly clothed with golden pile; wings hyaline, venation testaceous, stigma darker.

Male.—The male agrees well with the female except the clypeus has a strong, acute median tooth.

Duaringa, Dawson District, North Queensland, Australia. Seven females and five males from W. F. H. Rosenberg.

Type.—Cat. No. 14254, U.S.N.M.

PISON (PARAPISON) ERYTHROGASTRUM, new species.

Judging from the description this is colored similar to *pertinax* Turner, [illegible] that species has "the scape short, scarcely longer than the second [illegible] of the flagellum," the eyes narrowly emarginate and other points [illegible] difference. *P.* (*Parapison*) *erythrocerum* (Kohl) has the abdomen largely black.

Female.—Length 6 mm. Clypeus nearly three times as wide as long, slightly produced in the middle, the production having a broad, low, truncate process; space between the eyes at the clypeus about one-fourth greater than at the vertex; space between bases of antennae about half again as great as that between the antenna and eye; a very obscure impressed line from anterior ocellus, ocelli in an equilateral triangle; postocellar line about one-fifth longer than the ocellocular line; a transverse sulcus behind ocelli so the vertex appears raised; scape longer than the two following joints; antennae short, the third joint subequal with the second and fourth; head finely, closely punctured; pronotum long, not depressed below the mesonotum; [illegible] and meso-notum very finely, closely punctured; dorsal aspect of the propodeum subequal in length with mesoscutum, a strong median sulcus, which has a median carina, finely obliquely striate; sides of the propodeum separated from the dorsal and posterior aspects by a carina, very finely striato-punctate; posterior face of the propodeum finely, striato-punctate, with an incomplete median sulcus, the ventral margin foveolate; abdomen finely punctured, apical margin of three basal segments depressed, second slightly constricted basally; first recurrent vein slightly basad of apical third; second recurrent vein nearly interstititial with the (second) first transverse cubitus; (third) second cubital nearly pointed on radius; transverse median more than half its length basad of basal. Black; mandibles, palpi, antennae, legs below middle of trochanters, and abdomen ferruginous; face, below antennae and pectus with silvery pile; wings hyaline, iridescent; venation testaceous, stigma and costa brown.

Duaringa, Dawson District, North Queensland, Australia. One female from W. F. H. Rosenberg.

Type.—Cat. No. 14255, U.S.N.M.

Genus NYSSON Latreille.

NYSSON (BATHYSTEGUS) BASIRUFUS, new species.

Resembles to some extent *Nysson armatus* Cresson, but may be readily separated from that species by having the four anterior legs black.

Female.—Length 5.5 mm. Anterior margin of the clypeus broadly rounded; distance between the eyes at the clypeus about half the distance between them at the vertex; head finely granular with a few large punctures; ocelli in a low triangle; postocellar [illegible] slightly shorter than the ocellocular line; the intraocellar area r[illegible]d; mesonotum finely punctured with a number of large close punc[illegible]s which are denser anteriorly; scutellum punctured like the [illegible]notum; mesepisternum punctured like the mesonotum; propo[illegible] finely punctured; dorsal aspect separated from the posterio[illegible]ect by a carina, apically the dorsal aspect has three carinae [illegible]h are united in such manner as to form a double U, whic[illegible]s open anteriorly; legs practically without spines; venation n[illegible]l; the third cubital cell very narrow on the radius, the distance b[illegible]n the second and third transverse cubiti being subequal with th[illegible]tance between the second transverse cubitus and the first recu[illegible]vein; abdomen shiny, a number of small, well defined and we[illegible]rated punctures; pygidium about one and one-half times as lo[illegible]road, the apical margin nearly rounded. Black; narrow poste[illegible]margin of the pronotum, tubercule, two spots on the scutellum, [illegible]ate lateral spots, bands on the tergites from the first to the fourth inclusive (those on the first and second segments are broad) white; first abdominal segment, except where mentioned, and the posterior femora rufous; densely clothed with yellow pile which is denser on the front and cheeks; wings dusky hyaline; venation dark brown; antennae slightly thickening apically, the third and fourth joints [illegible]qual in length.

Mayaguez, Porto Rico. Described from one female c[illegible]d January 27, 1912, by C. W. Hooker.

Type.—Cat. No. 15082. U.S.N.M.

Genus CERCERIS Latreille.

CERCERIS MARGARETELLA, new species.

Apparently related to *Cerceris festiva* Cresson, but may be readily separated from that species by the different colored antennae and the yellow propodeal inclosure.

Male.—Length, 9.5 mm. Clypeus gently convex; anterior margin feebly crenulate; frontal carnia strong; ocelli in a low triangle; postocellar line a little shorter than the ocellocular line; head closely, regularly punctured except the area around and inclosed by the ocelli, which is shiny, but more sparsly punctured; antennae normal, third joint subequal in length to the fourth; mesonotum shiny, with a few irregular punctures; mesopleura with rather large, close punctures; propodeal inclosure shiny, impunctuate; propodeum shiny, with a few widely scattered punctures; stern[illegible]um rectangular in outline and without a triangularly shaped depression; abdomen shiny, with a few scattered punctures; pygidium about one and one-half times as long as broad, nearly parallel-sided, the apex truncate; last ventral abdominal segment deeply, arcuately emarginate, the lobes rather narrow, rounded apically. Black; spot on the base of mandibles, clypeus, inner orbits to a little above the antennae, supraclypeal area, a narrow line on the posterior orbits; pronotum, a spot on the tegula, a large spot below the tegula, a smaller spot below this large spot, scutellum, propodeal inclosure, elongate spots on the side of the propodeum, apical margin of the first tergite, apical margins of the second, third, and fourth tergites (broader laterally, bands on the third and fourth narrower) yellow; legs black; trochanters, the apices of the four anterior femora beneath, the four anterior tibiae and the basal half of the posterior tibiae (broader beneath) yellow; wings dusky hyaline, clear, basally, iridescent; venation dark brown; stigma pale brown; head and thorax clothed with erect gray hair; flagellum beneath piceous; lateral spots on the second, third, and fourth sternites yellow.

Mayaguez, Porto Rico. Three males collected by C. W. Hooker, January 29, 1912.

Type.—Cat. No. 15076, U.S.N.M.

CRITICAL NOTES ON THE SUBSPECIES OF THE SPOTTED OWL, STRIX OCCIDENTALIS (XANTUS).

By Harry C. Oberholser,
Of the Biological Survey, United States Department of Agriculture.

The four current subspecies of *Strix occidentalis*, with the geographical range apportioned to each, are as follows:

STRIX OCCIDENTALIS OCCIDENTALIS (Xantus).

Syrnium occidentale Xantus, Proc. Acad. Nat. Sci. Phila., 1859, p. 193 (Fort Tejon, California).

Southern California and northern Lower California.

STRIX OCCIDENTALIS CAURINA (Merriam).

Syrnium occidentale caurinum Merriam, Auk, vol. 15, January, 1898, p. 40 (Mount Vernon, Skagit Valley, Washington).

Southern British Columbia, south through western Washington and western Oregon to central California.

STRIX OCCIDENTALIS HUACHUCAE Swarth.

Strix occidentalis huachucæ Swarth, Univ. Calif. Publ. Zool., vol. 7, No. 1, May 24, 1910, p. 3 (Huachuca Mountains, Arizona).

Arizona, New Mexico, Colorado, and central western Texas.

STRIX OCCIDENTALIS LUCIDA (Nelson).

Syrnium occidentale lucidum Nelson, Proc. Biol. Soc. Wash., vol. 16, November 30, 1903, p. 152 (Mount Tancitaro, Michoacan, Mexico).

States of Guanajuato and Michoacan, Mexico.

Each of these forms was originally described from a single specimen, and the species is still uncommon in museums. Recent collecting for the United States Biological Survey has resulted in the acquisition of eight adult specimens of *Strix occidentalis huachucae*, all in fine adult autumn plumage, six of them from New Mexico, the others from Arizona. The types of *Strix occidentalis caurina* and *Strix occidentalis lucida* are also in the Biological Survey collection; while in addition the United States National Museum possesses the type of *Strix occidentalis occidentalis* and another California specimen; one adult *Strix occidentalis lucida* from Guanajuato, Mexico; and a practically topotypical example of *Strix occidentalis huachucae*. Through the kindness of Dr. Joseph Grinnell I have been able to examine the type of *Strix occidentalis huachucae;* and Dr. Louis B. Bishop has obligingly sent two specimens from New Mexico, together with three from Arizona, and two of *Strix occidentalis occidentalis* from California. Through Mr. H. S. Swarth it has been made possible to borrow nine more specimens of *Strix occidentalis occidentalis* from California, which he had brought together for a further study of his *Strix occidentalis huachucae.* He, furthermore, very courteously offered the writer the use of his manuscript notes made with the view of publishing a supplementary account. The above material, altogether 31 specimens, including 2 in juvenal plumage, constitutes by considerable the largest series of birds of this species that has ever been available at one time. A careful study of these for the purpose of identifying specimens in the collection of the Biological Survey, compels some surprising as well as interesting conclusions, which seem worthy of printed record.

The eight adult examples from New Mexico, together with the six from southern Arizona, represent what should be typical *Strix occidentalis huachucae.* This race, quoting the original description,[1] differs from *Strix occidentalis occidentalis* as follows:

"Similar to *Strix occidentalis occidentalis* (Xantus), but slightly smaller, and conspicuously paler; white markings more extensive and dark areas less deep toned."

An exhaustive comparison of this series of 14 adults from New Mexico and Arizona with typical *Strix occidentalis occidentalis* shows that all but one of the characters given to separate *Strix occidentalis huachucae* are merely individual. The difference of size is inconsiderable and inconsequential, as the appended measurements demonstrate; while the supposedly most important distinction, that of the lighter tone of the dark areas, appears in but five of the fourteen specimens, and many of the others are even *darker* than normal *Strix occidentalis occidentalis!* A single bird from Tucson, Arizona (No. 84433, U.S.N.M.), is the palest of the present series, being, in its light rufescent brown coloration, very much like the type of *Strix occidentalis huachucae,* but even lighter and more rufescent, with more tinge of ochraceous on the face and lower parts. A specimen from the Santa Rita Mountains (No. 241139, U.S.N.M.), some 30 or 40 miles south of Tucson is, however, as dark as the type of *Strix occidentalis caurina,* the supposedly darkest form of the species. Other examples from New Mexico are even darker. Thus, light rufescent birds like the Tucson specimen above mentioned, together with others nearly as light in ground color, from New Mexico and Arizona, are found geographically intermingled with dark birds, and must be considered, therefore, merely as representing a color phase. There is, likewise, nothing but individual variation in the amount of dark mottling on the legs and feet of these specimens, so that this can not be a racial characteristic. The only characters, so far as we can discover, which will distinguish *Strix occidentalis huachucae* from *Strix occidentalis occidentalis* are the larger white markings on scapulars, cervix, superior wing-coverts, and posterior lower parts; together with the paler, often whitish bars on wing-quills and tail-feathers. This increase of white is most conspicuous and most nearly constant on the scapulars, only average on the other parts; but taken together, seems sufficient for the recognition of the Arizona race as distinguished from that of California.

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[1] Swarth, Univ. Calif. Publ. Zool., vol. 7, No. 1, May 26, 1910, p. 3.

Another subspecies described as *Syrnium occidentale lucidum* from Mount Tancitaro, Michoacan, Mexico, by Mr. E. W. Nelson,[1] was diagnosed as follows:

"Darker and with much less yellowish buffy suffusion throughout than *S. occidentale;* white markings larger and clearer white."

The type is identical in all respects with a specimen from Taylor Creek, Socorro County, New Mexico, except for being not quite so dark above as the latter. As a matter of fact, most of the birds in the New Mexico and Arizona series are fully as dark as the type of *Strix occidentalis lucida,* several of them even more deeply colored. Another Mexican example, from Guanajuato, is the same as *Strix occidentalis lucida* from Michoacan, though somewhat lighter than the type, with almost immaculate white legs and feet and more restricted white markings on the upper surface. From others of the Arizona and New Mexico series it can not be distinguished. Since, furthermore, all the characters valid for the separation of *Strix occidentalis lucida* from *Strix occidentalis occidentalis* are the same as those distinguishing *Strix occidentalis huachucae* from *Strix occidentalis occidentalis*, it follows that *Strix occidentalis lucida* and *Strix occidentalis huachucae* are identical. Thus the name of the Arizona race becomes *Strix occidentalis lucida* Nelson,[1] because this name has several years priority over *Strix occidentalis huachucae* Swarth.[2]

The above comparisons necessarily involved an examination of *Strix occidentalis caurina,* from Mount Vernon, Washington. This was originally described[3] as differing from *Strix occidentalis occidentalis* principally by reason of darker general coloration and reduced white markings. The before-mentioned specimens from California prove beyond reasonable doubt that *Strix occidentalis caurina* is a synonym of *Strix occidentalis occidentalis,* for all its peculiarities are to be found among these California birds. Many of the specimens of *Strix occidentalis lucida* from Arizona and New Mexico are fully as dark above as is *Strix occidentalis caurina,* and some are even darker; several are as dark below, with nearly the same amount of ochraceous suffusion posteriorly, and with practically an equal amount of mottling on the legs and feet. In the reduction of light markings on the upper surface the type of *Strix occidentalis caurina* may be closely matched in all respects by some of the California birds, as well as by the type of *Strix occidentalis occidentalis*. Moreover, the type of *Strix occidentalis occidentalis* is an old, formerly mounted specimen, and is considerably faded and apparently otherwise discolored. Another southern California example (No. 1392, collection of G. Willett) is actually identical with the type of *Strix occidentalis caurina*, except for being *darker*. There is thus no distinctive character left for the recognition of *Strix occidentalis caurina* as a subspecies.

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[1] Proc. Biol. Soc. Wash., vol. 16, November 30, 1903, p. 152.

[2] Univ. Calif. Publ. Zool., vol. 7, No. 1, May 26, 1910, p. 3.

[3] Merriam, Auk, vol. 15, 1898, p. 40.

From what has already been said it is evident that there [illegible] but two forms of *Strix occidentalis*, instead of four, although both have a relatively wide geographical range. The only characters that now appear to be of value for the separation of these geographic races are in the size and distinctness of the white markings on the feathers, principally of the upper parts, though also below, but there is great variation even in this respect in the series of specimens examined.

The following millimeter averages of birds from various regions throughout the range of the species, show clearly of how little subspecific value is any difference of size:

Localities.	Wing.	Tail.	Exposed culmen.	Culmen from cere.	Tarsus.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Four males (*Strix occidentalis occidentalis*), from California	309.8	202	30.9	20.9	52.5
Seven males (*Strix occidentalis lucida*), from Arizona and New Mexico	307.1	199.9	29.8	20.3	53.1
Six females (*Strix occidentalis occidentalis*), from California	310.8	206.1	31.8	22.2	53.6
One female (*Strix occidentalis occidentalis*), from Washington	304	198	31.5	21.3	54
Six females (*Strix occidentalis lucida*), from Arizona and New Mexico	312.7	206.1	31	21.3	53.4
Two females (*Strix occidentalis lucida*), from central Mexico	311	203	30.6	21.7	54

This reduction of the four described and currently recognized subspecies of *Strix occidentalis* to two closely allied forms is a surprising conclusion, in view of the wide geographical range of the species—from central Mexico to southern British Columbia—and also of the well-known tendency of owls in general to form numerous geographical races, but it is inevitable from an examination of the material now available. The only other course possible is to reduce them to a single form. The present result is, however, nearly paralleled by the unexpected, but none the less apparently correct conclusion by Mr. Robert Ridgway[1] concerning the lack of any recognizable subspecies in *Otus flammeolus*. It shows, too, that geographic or physiographic analogy, though of considerable assistance in working out geographical races, is an unsafe guide alone.

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[1] Bull. U. S. Nat. Mus., No. 50, pt. vi, April 8, 1914, pp. 728-730.

Our investigation has resulted, furthermore, in the interesting discovery that there are two well-marked color phases in *Strix occidentalis*, the lighter of which is of comparatively rare occurrence. One of these phases is characterized above by a deep clove brown ground color, below by markings of similar color, and is represented by many of the specimens in the Arizona-New Mexico series, as well as by the types of *Syrnium occidentale caurinum* Merriam and *Syrnium occidentale lucidum* Nelson. The other phase is rather light rufescent brown above, with similar markings below, and is exemplified by the specimen from Tucson (No. 84433, U.S.N.M.). Between these two phases there are various intermediates, represented in our series by the types of *Strix occidentalis occidentalis* and *Strix occidentalis huachucae;* several further examples from Arizona and New Mexico, and a specimen from Pasadena, California (No. 135190, U.S.N.M.).

Another point, which the measurements bring out, and which seems worthy of notice, is that the female in this species is but little larger than the male, showing much less difference in this respect than is usual among owls.

In view of the above conclusions, the races of this species will now stand as follows:

STRIX OCCIDENTALIS OCCIDENTALIS (Xantus).

Syrnium occidentale Xantus, Proc. Acad. Nat. Sci. Phila., 1859, p. 193.
Syrnium occidentale caurinum Merriam, Auk, vol. 15, January, 1898, p. 40.

Type-locality.—Fort Tejon, California.

Geographical distribution.—Pacific coast region of the United States, in Washington, Oregon, and California; also north to southern British Columbia; south to northern Lower California; and east to eastern California.

Measurements.[1]—Male: Total length (in flesh), 436.9 mm.;[3] extent of wing, 763.[2]

Female: Total length (in flesh), 431.8–489 (average, 463.6) mm.;[3] extent of wing, 1041.4.[2]

Male:[4] Wing, 301–322 (average, 309.8) mm.; tail, 200–204 (202); exposed culmen, 29.3–32 (30.9); culmen from cere, 20.5–21.2 (20.9); tarsus, 51–54.5 (52.5).

Female:[5] Wing, 304–315 (average, 309.9) mm.; tail, 193–213 (204.9); exposed culmen, 30–33 (31.7); culmen from cere, 20–23.8 (22); tarsus, 53–54 (53.7).

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[1] Measurements in this paper are in millimeters, and have been taken as explained in the writer's article on *Butorides virescens* (Proc. U. S. Nat. Mus., vol. 42, August 29, 1912, p. 533), except for "culmen from cere," which is the chord of the culmen taken from the tip of the maxilla to the anterior edge of the cere.

[2] One specimen.

[3] Three specimens.

[4] Four specimens, from California.

[5] Seven specimens, from California and Washington.

Detailed measurements of the specimens of this race examined are as follows:

Measurements of specimens of Strix occidentalis occidentalis.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed cul[illegible]	Culmen from cere.	Tarsus.
					mm	*mm*	*m*[illegible]	[illegible]	*mm*
L.B.Bishop 26195[1]	Male....	Near Monrovia (alt., 2,500 ft.), Los Angeles Co., Cal.	Nov. 3,1913	G. Willett...	311	204	31[illegible]	[illegible]	51.5
G. Willett 1392[1]..	...do.....	.....do................	Nov. 9,1913	.....do.......	305	201	32	[illegible]	53
U.S.N.M. 17200[1]..	...do.....	Fort Tejon, Cal.[2].....	....	J. Xantus...	322	203	31.[illegible]	[illegible]	51
U.S.N.M. 135190[1].	...do.....	Pasadena, Cal.......	Nov. 1,1894	W. B. Judson.	301	200	29.[illegible]	[illegible]	54.5
G. Willett 830[1]...	Female.	Fillmore, Ventura Co., Cal.	Dec. 13,1910	A. N. Stone.	305	193	31.[illegible]	[illegible]	54
L.B.Bishop 26196[1]	...do.....	.....do................	.....do........	.....do.......	315	203	32.[illegible]	[illegible]	53
C. H. Richardson jr. 495.[1]	...do.....	Wilson Peak Trail, Los Angeles Co., Cal.	Mar. 21,1905	C. H. Richardson, jr.	309	211.5	33	[illegible]	54
G. Willett 1393[1]..	...do.....	Near Monrovia (alt., 2,500 ft.), Los Angeles Co., Cal.	Nov. 3,1913	G. Willett...	315	208	31.[illegible]	23.8	53
L. H. Miller——[1]..	...do.....	Castac Creek, Los Angeles Co., Cal.	Apr. 10,1911	L. H. Miller.	310	213	....	....	....
F. S. Daggett 4526[1]	...do.....	San Dimas Canyon, Pomona, Cal.	Feb. 14,1903	F. S. Daggett.	311	208	30	22.5	54
U.S.N.M.157473[1]..	...do.....	Mount Vernon, Wash.[3]	June 22,1897	E.A. Preble.	304	198	31.[illegible]	21.3	54
L. H. Miller ——..	Female, juvenal.	Forest Home, Cal....	Aug. 17,1913	L. H. Miller.	....	....	....	....	....
Mus. Hist. Sci. Art ——.	....	Hills west of Newhall, Los Angeles Co., Cal.	May 20,1906	H. J. Lelande.	310	203	31.3	20.5	53
G. Willett 1395....	....	Near Monrovia (alt., 2,500 ft.), Los Angeles Co., Cal.	Nov. 3,1913	G. Willett...	314	211	31	[illegible]	51.5

[1] Used in measurement averages on p. 255.
[2] Type of *Syrnium occidentale* Xantus.
[3] Type of *Syrnium occidentale caurinum* Merriam.

STRIX OCCIDENTALIS LUCIDA Nelson.

Syrnium occidentale lucidum NELSON, Proc. Biol. Soc. Wash., vol. 16, November 30, 1903, p. 152.

Strix occidentalis huachucæ SWARTH, Univ. Calif. Publ. Zool., vol. 7, No. 1, May 26, 1910, p. 3.

Type-locality.—Mount Tancitaro, Michoacan, Mexico.

Geographical distribution.—Southwestern United States and northern and central Mexico; north to Colorado; west to Arizona; south to Michoacan and Guanajuato; and east to western Texas, eastern New Mexico, and central Colorado.

Chars. subsp.—Similar to *Strix occidentalis occidentalis*, but white markings on scapulars, upper wing-coverts, cervix, and posterior lower parts larger; light bars on remiges and rectrices more whitish.

Measurements.—Male: Total length (in flesh), 419.1–444.5 (average, 434.3) mm.;[4] extent of wing, 1054.1–1073.2 (1065.3).[5]

Female: Total length (in flesh), 419.1–457.2 (average, 441.5) mm.;[5] extent of wing, 1041.4–1098.3 (1073.2).[5]

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[4] Five specimens.
[5] Four specimens.

Male:[1] Wing, 302–309 (average, 307.1) mm.; tail, 191–206 (199.9); exposed culmen, 27–32 (29.8); culmen from cere, 18.6–21.5 (20.3); tarsus, 52–54 (53.1).

Female:[2] Wing, 302–320 (average, 312.3) mm.; tail, 196–212.5 (205.3); exposed culmen, 29–33 (30.9); culmen from cere, 19.5–23 (21.4); tarsus, 51.5–55.5 (53.6).

Detailed measurements are added in the following table:

Measurements of specimens of Strix occidentalis lucida.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Culmen from cere.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*	*mm*
H. S. Swarth 3691[3].	Male....	Huachuca Mts., Ariz.[4]	Apr. 11, 1903	H. S. Swarth	308	193	29.5	20	53
U.S.N.M. 241139[3]..	...do.....	Stone Cabin Canyon (alt., 7,000 ft.), Santa Rita Mts., Ariz.	Oct. 28, 1913	V. Bailey...	309	205	29	20	53
L. B. Bishop 16876[3]	...do.....	Santa Catalina Mts., Ariz.	July 7, 1906	H. Kimball.	302	191	32	21.5	53.5
L. B. Bishop 26164[3]	...do.....	Kelly Canyon (alt., 6,500 ft.), western side of San Mateo Mts., Socorro Co., N. Mex.	Mar. 23, 1914	J. S. Ligon..	307	201	27	20.5	53.5
U.S.N.M. 241186[3].	...do.....	Head of Chloride Creek (alt., 8,000 ft.), 12 miles west of Chloride, Sierra Co., N. Mex.	Dec. 20, 1913	.....do.......	309	201	30	18.6	53
U.S.N.M. 241183[3].	...do	6 miles west of Chloride (alt., 6,500 ft.), Sierra Co., N. Mex.	Oct. 22, 1913	.....do.......	309	206	31	21	54
U.S.N.M. 240762[3].	...do.....	15 miles northeast of Monticello (alt., 7,000 ft.), San Mateo Mts., Socorro Co., N. Mex.	Oct. 1, 1913	.....do.......	306	202	30	20.5	52
L. B. Bishop 16878	Male, juvenal.	Santa Catalina Mts., Ariz.	July 7, 1906	H. Kimball.	....	.....	....	....	....
U.S.N.M. 241184[3].	Female .	3 miles north of Eagle Peak (alt., 8,000 ft.), Tularosa Range, Socorro Co., N. Mex.	Dec. 5, 1913	J. S. Ligon..	315	206	31.3	20.5	54.5
U.S.N.M. 241185[1] .	...do.....	Head of Chloride Creek (alt., 8,000 ft.), 12 miles west of Chloride, Sierra Co., N. Mex.	Dec. 20, 1913	.....do.......	309	208	30.8	21.8	52.5
U.S.N.M. 241138[3].	...do.....	Taylor Creek (alt., 7,000 ft.), 30 miles west of Chloride, Socorro Co., N. Mex.	Nov. 3, 1913	.....do.......	308	205	29	21.8	51.5
L. B. Bishop 26165[3]	...do.....	Bear Canyon (alt., 7,000 ft.), 12 miles northwest of Fairview, Sierra Co., N. Mex.	Mar. 7, 1914	.....do.......	320	212.5	32	21	53.5
U.S.N.M. 84433[3]..	...do.....	Tucson, Ariz........	Nov. 7, 1872	C. E. Bendire.	304	205	30	19.5	53
L. B. Bishop 16877[3]	...do.....	Santa Catalina Mts., Ariz.	July 7, 1906	H. Kimball.	320	200	33	23	55.5
U.S.N.M. 185269[3].	...do.....	Mount Tancitaro, Michoacan, Mex.[5]	Feb. 27, 1903	E. W. Nelson and E. A. Goldman.	320	210	31	22.5	55
U.S.N.M. 81925[3]..	...do.....	Guanajuato, Guanajuato, Mex.	....	A. Dugés....	302	196	30.2	20.8	53
U.S.N.M. 241187...	....	Blue, Ariz..........	May —, 1914	B. V. Lilly..	321	212	31.5	22	54.5

[1] Seven specimens, from Arizona and New Mexico.

[2] Eight specimens, from Arizona, New Mexico, Michoacan, and Guanajuato.

[3] Used in measurement averages on p. 257.

[4] Type of *Strix occidentalis huachucae* Swarth.

[5] Type of *Syrnium occidentale lucidum* Nelson.

NOTES ON THE LIFE HISTORY AND ECOLOGY OF THE DRAGONFLIES (ODONATA) OF WASHINGTON AND OREGON.

By Clarence Hamilton Kennedy,
Of Stanford University, California.

My interest in western Odonata started with the collecting I did in eastern Oregon in 1898 for Mr. E. B. Williamson, who has ever since encouraged me in further work along the same line. Since 1901 I have had further encouragement through correspondence with Dr. E. M. Walker, who has very kindly assisted me in the determination of Aeshnid material and in the determination of various nymphs. Without such help, work on western insects would be very difficult, because of the inaccessibility of much of the literature. That which is available is purely systematic and written by men who have only in rare cases seen the living insects in the field, because of which I have in this paper made live color notes and ecological data very full. This is the first of three general papers on western Odonata. The second is in preparation, and covers collecting done in California and Nevada during 1914. The summer of 1915 I hope to spend collecting in the southwestern States, and to publish the results in the third paper. A list of western Odonata is in preparation, but will not be completed until after this third summer's work is finished.

1. NOTES ON ARCHILESTES CALIFORNICA.

Only two species are known in the genus *Archilestes*. *Archilestes grandis* is a species long known from Mexico, Central America, and the Southwestern United States, having been first described by Rambur as *Lestes grandis* in the year 1842. In 1862 Selys raised the single species to generic rank as *Archilestes grandis*. In 1895[1] McLachlan described a new species, which he named *californica*. It was based on a single male specimen, presumably obtained in "California." The second species was based on differences in coloration, the main points of which were, that *californica* lacked a metallic coloration and had the costa and median veins yellowish. In 1901 Calvert[2] listed as *grandis* a single male specimen collected at Yakima, Washington.

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[1] McLachlan, R. Some new species of Odonata of the "Legion" Lestes. Ann. Nat. Hist., ser. 6, vol. 16, p. 20, 1895.

[2] Calvert, Philip P., Biologia Centrali-Americana, Odonata, p. 46, October, 1901.

During the past season (1913) I found *Archilestes* abundant on Satus Creek, Washington, from August 1 until October frosts killed the brood at the height of its numbers. A few specimens were taken in my dooryard 2 miles north of Sunnyside, Washington, which had emerged from nymphs brought down from the Yakima River in the Sunnyside irrigation canal, on whose bank my home stood. Probably because of the widely scattered points at which *Archilestes* has been taken in the Yakima Valley, it is found throughout the lower stretches of the Yakima River and its tributaries. However, as no record exists of specimens having been taken north of California, this is probably an isolated brood, perhaps the northern outpost of the genus.

As there are certain differences between the specimens of the brood from Satus Creek, Washington, and specimens of *grandis* from Mexico which I have examined, and as these correspond fairly well with McLachlan's description of *californica,* I have used the name *californica.* At first I thought their isolation had given them perhaps the characters of a local race and so inclined to classify them as *grandis,* but on collecting in the Sacramento Valley and after studying the specimens of *Archilestes* in the Stanford collection, which have been taken around Palo Alto, I am inclined to think that *californica* is a good species, as all the California material is identical with the Yakima Valley specimens. The main differences are that the specimens of *californica* are smaller, lighter colored, and have less metallic coloration than the true *grandis* forms. McLachlan states that the costa and median veins in the *californica* type are yellow. In some of my Yakima material, which is old and pruinose, the subcostal vein is light brown, though none have any of the veins distinctly yellow.

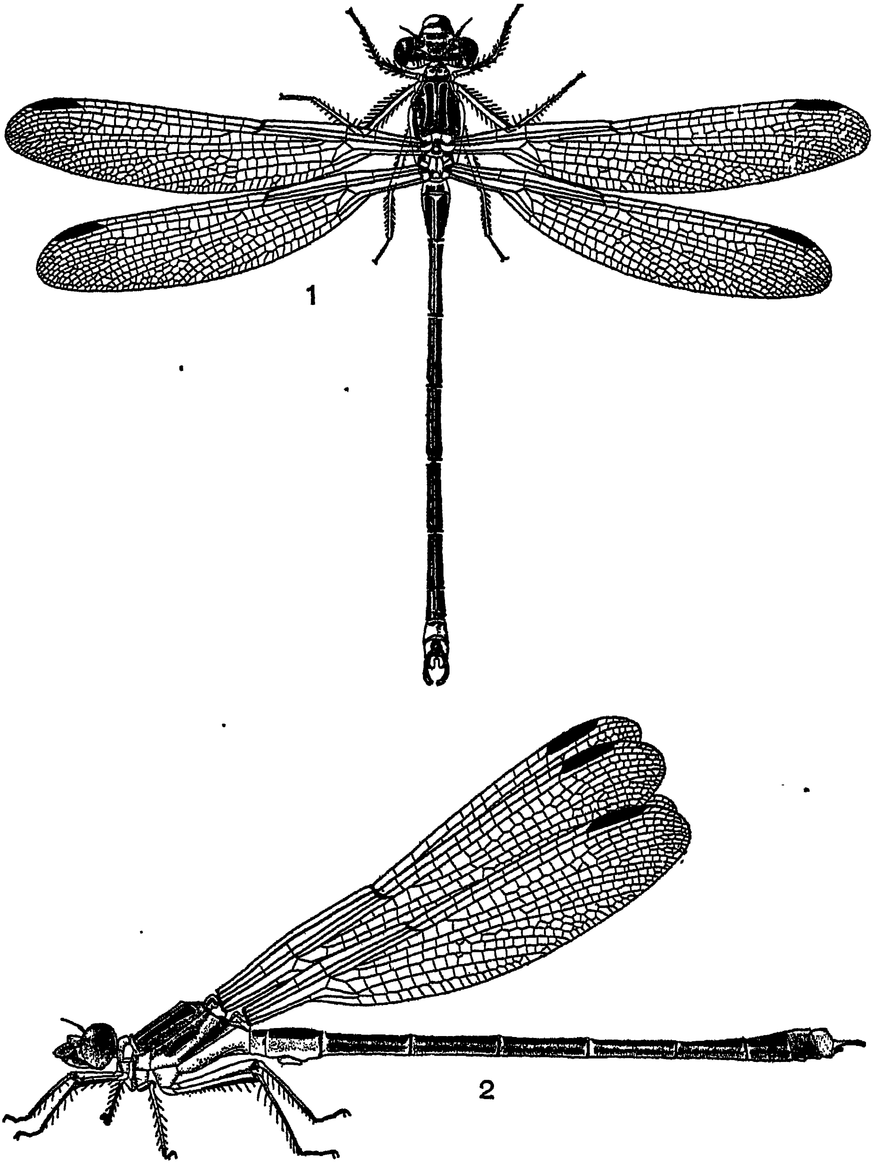
The following is a brief description of specimens from Satus Creek, Washington:

ARCHILESTES CALIFORNICA McLachlan.

Figs. 1–26.

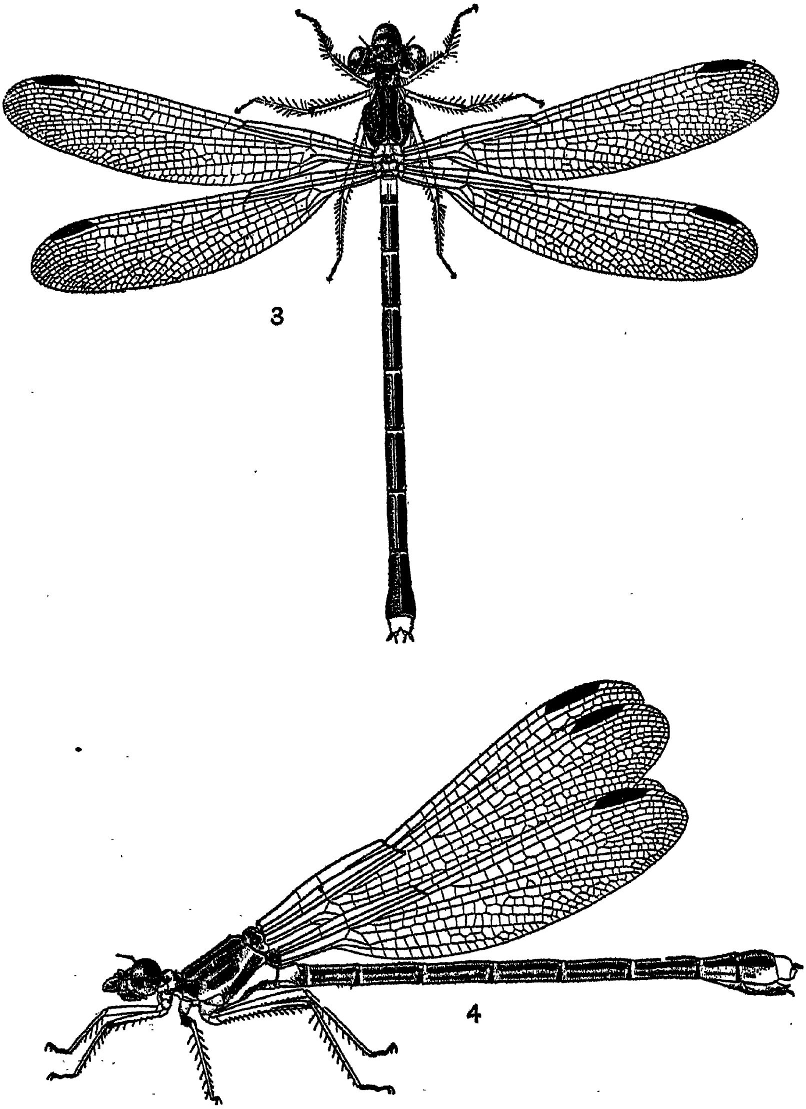
Male (figs. 1 and 2).—Labrum in teneral specimens pale brown, becoming greenish in the older males; frons pale brown on vertical surface, and brown with a black transverse line on the horizontal surface. Vertex brown, with a complex pattern in black. In the older specimens the dorsal surfaces of the head become black, with the brown areas reduced to fine pencilings. Antennae black, except a brown ring around apex of second segment. Eyes in mature males blue in the upper half, shading into gray below.

Prothorax pale brown in teneral specimens, with a transverse row of four black spots. In older specimens the general color becomes darker, the posterior lobe becomes black, and the sides become pruinose. Legs brown, with a black stripe on the anterior and another on the interior faces of femur and tibia. Tarsi black.



Figs. 1-2.—Archilestes californica, male. 1. Dorsal view. 2. Lateral view.

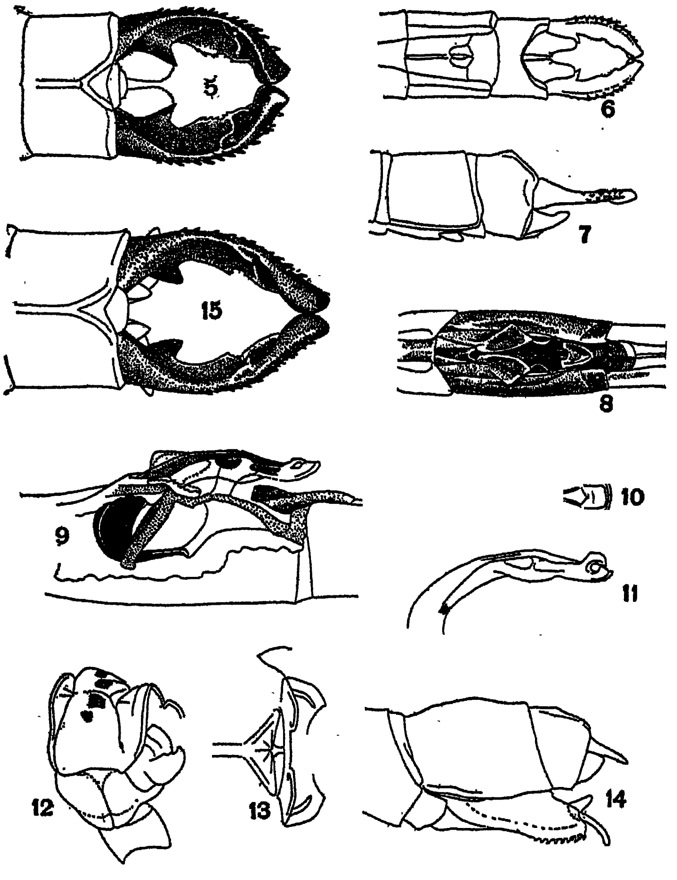
Mesothorax and metathorax in teneral specimens brown, darker above. Each mesepisternum with a black stripe entirely surrounded by a narrow light-brown line. This black stripe usually occupies from one-third to one-half the width of the mesepisternum, widens upward, and its inner upper angle touches the antealar sinus. Each mesepimeron with an elliptical or sometimes quadrangular



FIGS. 3-4.—ARCHILESTES CALIFORNICA, FEMALE. 3. DORSAL VIEW. 4. LATERAL VIEW.

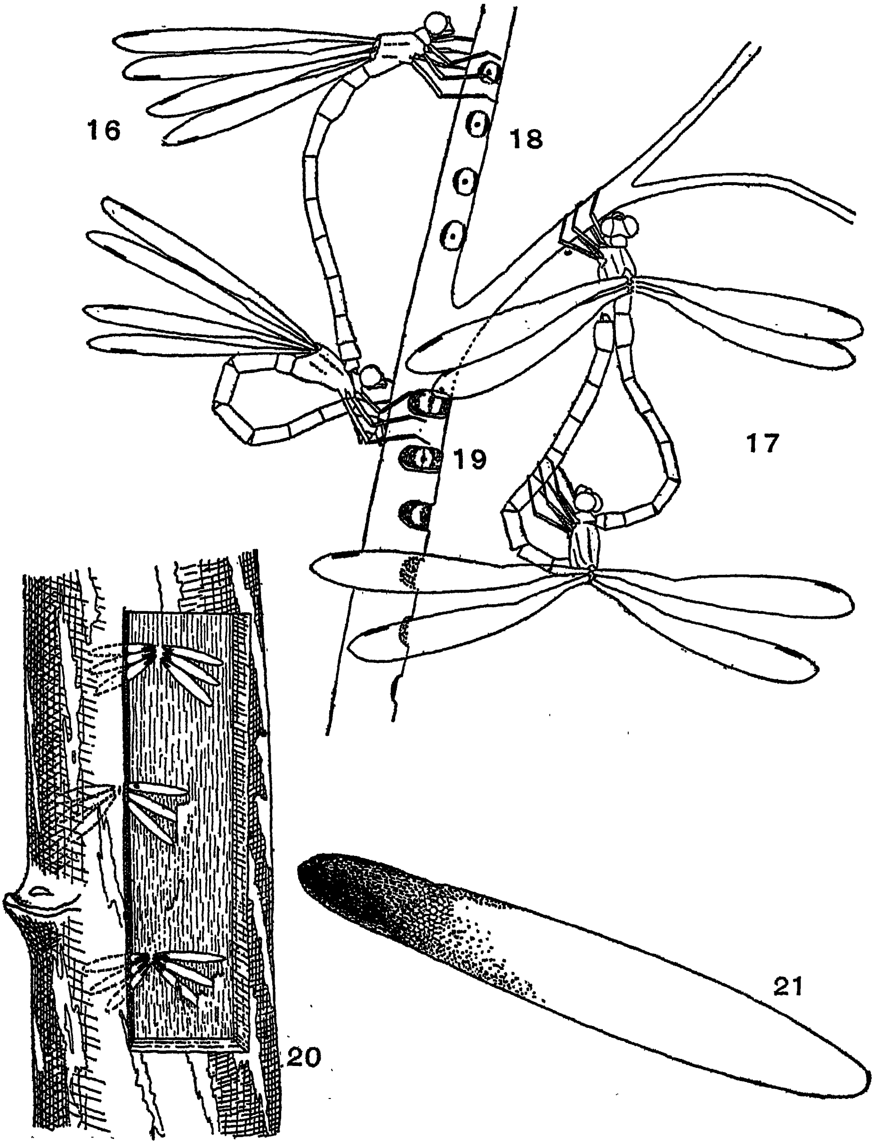
black spot extending over the two middle fourths of its length. Just posterior to this, but on the metepisternum, a creamy stripe, which becomes white pruinose in the mature males. This is followed by a stripe anterior to the second lateral suture, which is brown and does not become pruinose. The metepimeron is brown in the teneral, with creamy areas, but becomes white pruinose in the adult. Legs colored as in the prothorax. Wings hyaline, with brown stigmas.

Abdomen in teneral specimens pale brown, with the following markings: All segments with a narrow apical black ring; segment 1 with a black spot on each side of dorsal surface; segments 2–8 black on dorsal surface, with a narrow interrupted basal band and a fine middorsal line; segments 9–10 pale brown. Superior appendages with distal two-thirds black. The dorsal black areas of the abdomen show slight greenish metallic reflections. In the mature males the brown areas of the abdomen become darker and the black areas lose



Figs. 5–14.—Archilestes californica, Yakima material. 5–7. Male appendages. 8. Male segment 2, ventral view. 9. Male segment 2 showing chitinous framework. 10–11. Penis. 12. Female prothorax. 13. Female mesostigmal lamina. 14. Female abdominal segments 9 and 10. 15. Archilestes grandis, Guatemala material, dorsal view of male appendages.

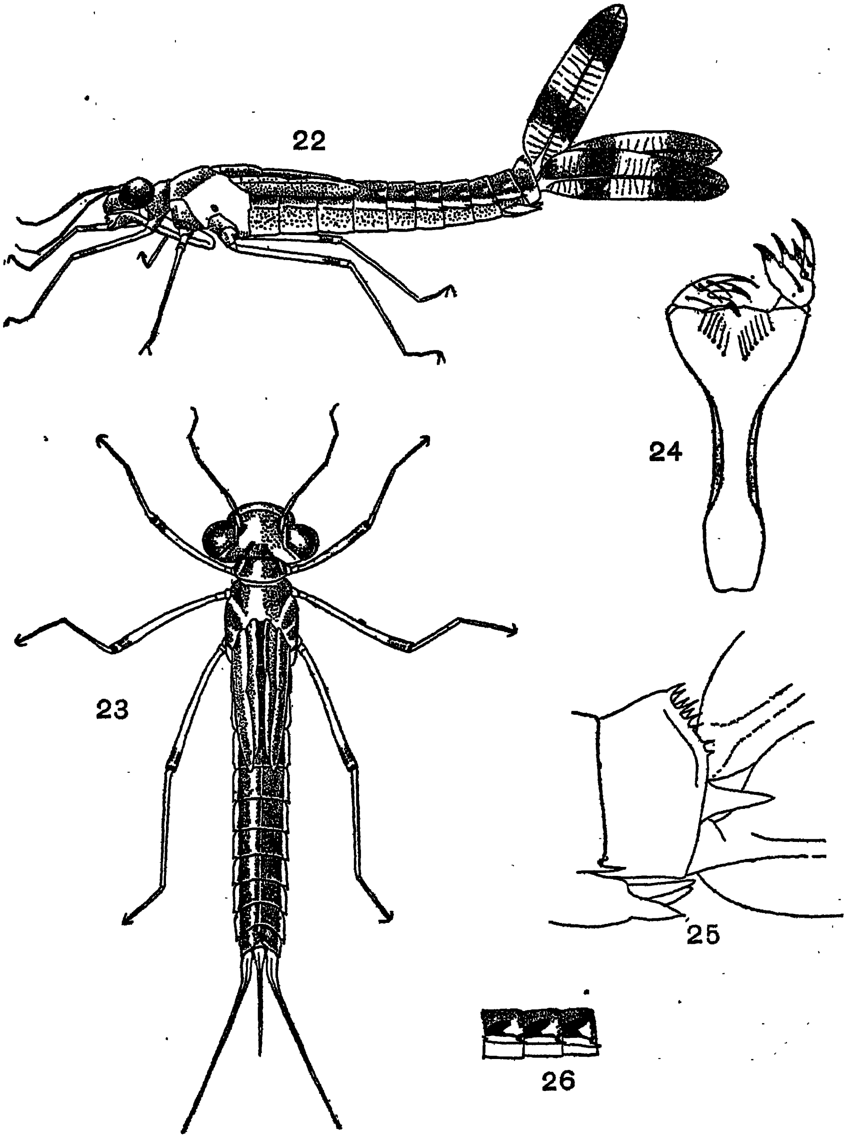
the metallic tints, while the sides of segments 9 and 10 become bluish pruinose.



FIGS. 16–21.—ARCHILESTES CALIFORNICA. 16. OVIPOSITING. 17. IN-COPULATION. 18. SCARS FROM OVIPOSITION, ONE YEAR OLD. 19. SCARS TWO YEARS OLD. 20. BARK CUT AWAY SHOWING EGGS IN CAMBIUM. 21. EGG.

Female (figs. 3 and 4).—Coloration identical with that of the male, both in teneral and mature imagoes, except that in the female the hind pair of legs are usually less heavily striped and segment 9 of the abdomen is black above as in segments 2–8.

Figure 15 shows a dorsal view of the appendages of a typical male *grandis* from Guatemala. Just above it, figure 5, is a drawing to the same scale of a male *californica* taken on Satus Creek. The slight differences in greater convexity of the outer rim of the appendages of the Satus specimen with the other minute peculiarities noticeable occur in about the same degree in all the Satus material.



FIGS. 22-26.—ARCHILESTES CALIFORNICA, NYMPH. 22. LATERAL VIEW. 23. DORSAL VIEW. 24. LABIUM. 25. ABDOMINAL SEGMENT 10. 26. COLOR OF A LIVE PALO ALTO, CALIFORNIA, SPECIMEN.

Calvert[1] writes that in a large series of Mexican and Central American material such slight intergrading differences are to be found, but Doctor Ris, after comparing a series of the Yakima specimens with the series of *grandis* in his collection, considered *californica* a good species.

Figures 6 and 7 show ventral and lateral views of the male appendages.

As *Archilestes* is a peculiar genus and contains only these two species, I have taken this opportunity to figure some of the grosser anatomical peculiarities. Figure 9 shows the chitinized parts of the sexual apparatus in the second segment of the male, lateral view. The dorsal or inner arm of the penis is held by a single pair of heavy supports. The parts supporting its inner tip are not chitinized. The external tip of the penis has a small, fleshy, ventral lobe and a large, almost circular, disc-shaped dorsal lobe. (See figs. 10 and 11.) A ventral view of the second segment in the male is shown in figure 8.

Figure 13 shows the mesostigmal lamina of the female, which is rather complex. Figure 12 shows the prothorax of the female, which does not differ from that of the male. Figure 14 is a lateral view of the ninth and tenth segments of the female abdomen with their appendages.

Archilestes in the Yakima Valley is an autumnal insect. When it first appears, the following summer species are disappearing: *Agrion aequabile yakima, Argia emma, Argia vivida, Ophiogomphus severus, Aeshna multicolor, Macromia magnifica, Libellula forensis,* and *Plathemis lydia.*

The first specimens of *Archilestes* were taken July 27. These were few in number and all very teneral. On August 3 perhaps as many as a hundred were seen in the willow glades branching from the main channel of the creek, and on August 7 *Archilestes* were common. The breeding season for *Archilestes* lasted, then, until about September 14, when several frosts occurred and collecting did not begin until 10 o'clock in the morning and was practically over at 2 o'clock. At this date the only other dragonflies on the wing were *Lestes congener, Ischnura perparva, Ischnura cervula, Aeshna palmata, Aeshna umbrosa occidentalis, Sympetrum pallipes,* and *Sympetrum vicinum.* At this late date *Lestes congener, Archilestes californica, Aeshna palmata, Aeshna umbrosa occidentalis,* and *Sympetrum vicinum* were at the height of their season. Six weeks later stragglers of these species were still on the wing along Yakima River.

During August, or until active breeding began, the individuals of this species with wings held loosely open were usually found hanging on the leaves and stems on the sunny side of willow and alder bushes. Here each appeared to have its favorite position, from which it would fly up and out a distance of 6 to 10 feet from time to time to take passing insects, returning each time to its resting place. On being disturbed none ever hesitated to dart into the densest portion of the bush on which it rested. Many, especially tenerals, rested on grass, and such when attacked flew into the nearest bush. Even fully developed imagoes were never on the wing for any great length of time, seldom at any time flying more than 20 or 30 feet; but in spite of their apparently weak flight they were not easily taken, because a single stroke with the net would send all the near-by individuals into the bushes.

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[1] Calvert, P. P. The Odonata of Baja California, Mexico. Proc. Cal. Acad. Sci., ser. 2, vol. 4, 1894, p. 555.

On September 7 it was observed that they were more abundant about the willow-fringed pools than formerly, where many couples were now flying from bush to bush. On both September 7 and September 14, which was the last date on which collecting was done on the creek, oviposition was in progress.

In capturing the female the male flies toward her while she is on the wing, or if she is alighted, as is the usual case, she flies up to meet him, when he first seizes her head with his feet, then bending his abdomen forward, seizes her prothorax with the claspers on the tip of his abdomen. She usually copulates at once, which is a lengthy process, the pair in copulation restlessly wandering from place to place. (See fig. 17.)

After many minutes in copulation they settle down on a vertical willow twig from one-fourth to one-half an inch in diameter overhanging some pool, or which may be even 3 feet back from the water and at a distance of from 2 to 10 feet above the surface of the water, and begin the tedious process of oviposition. (See fig. 16.) The male holds the female during oviposition. The female draws the tip of her abdomen up until her body forms a loop with the ovipositor between her legs, when she makes in the willow branch a downward thrust. On examination of twigs it was found that no egg is laid in this first downward thrust. Next she partly withdraws the ovipositor, making a lateral thrust on the right side. This is for the first egg. A third thrust is made in the same side by partially withdrawing the ovipositor first and aiming it forward of the second. A fourth thrust is made forward of the third for the third egg. Then she twists the tip of the abdomen around, making three thrusts on the left side, the lower thrust first, the upper thrust last. In each of the six lateral thrusts an egg has been laid with the small dark end at the point of insertion. (See figs. 20 and 21.) After such a series of eggs has been laid the female withdraws her ovipositor and the pair back down the branch about one-fourth of an inch and repeat the process. One pair was watched for an hour, at the end of which time the female took longer rests between thrusts and finally ceased ovipositing.

The eggs probably pass the winter in the live cambium tissue of the twigs, for in a twig I kept alive until January 1, 1914, the eggs were yet unhatched. While traveling with it the twig died, so further observations were impossible. As the eggs are laid in bushes which in the floods of spring snow water would be partially submerged, the hatching nymphs probably find their way easily into the water. After laying, the puncture made by the ovipositor of the female closes, so that during the following winter it is found with difficulty, but in the second season of the scar it appears as a small hole surrounded by the circle of dead bark under which lay the six eggs. (See fig. 18.) With further growth this circular scar does not heal, but widens laterally so that a series of puncture scars in their third season appear as a series of lenticular depressions in the growing twig. (See fig. 19.) Many twigs are killed by being girdled with puncture scars. These seem to disfigure alder bushes more often than willows, perhaps because of the slower growth of the alder. The older scars run in series of from 12 to 30 in number. With 6 eggs deposited in each scar it would appear that the female lays from 70 to 180 eggs before tiring.

While ovipositing the pair are remarkably indifferent to enemies, as both can be easily picked up by the hand.

Though I watched carefully I found only one place along the creek where ovipositing took place. This was in the alders and willows along a scum-covered stagnant pool of the creek. Such pools occurred about two to every mile. This was fringed by a thick growth of *Juncus* and *Scirpus*, on the smooth stems of which were found many exuviae of *Archilestes*. These were from 2 to 12 inches above the surface of the water. The bottom of this pool was covered with soft mud and the water was filled with floating masses of filamentous algae, but though I spent an hour raking this pool for nymphs I found none.

Nymph.—The nymph of *Archilestes grandis* (?) has been described by Needham[1] from Arizona specimens, but as my nymphal skins differ in certain minor characters from his description, I have indicated these differences.

The most noticeable difference is in size. They are in all measurements about one-fourth smaller than the Arizona nymphs. The following are the measurements of the Satus specimens: Length, including gills, 28–31 mm.; gills, 9–10; abdomen, 14–15; hind femur, 6; antenna, 6; width of head, 5; width of abdomen, 3.

These Satus specimens (see figs. 22–26) are among themselves very uniformly marked and differ in certain points from Needham's description of Arizona nymphs. The main points of their coloration

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[1] Needham, James G. New dragon-fly nymphs in the United States National Museum. Proc. U. S. Nat. Mus., vol. 27, No. 1371, pp. 685–720, pls. 38–44, 11 figs, May 20, 1904. See pp. 712–713, pl. 42, fig. 3.

are as follows: The abdomen (see fig. 26) below the lateral keel is uniformly pale. Above each lateral keel is a narrow white stripe, jogged at the end of each segment as is the lateral keel. There is a small black apical spot on the side of each segment just above the lateral white line. Above each black spot is a white spot. The remainder of the dorsum of the abdomen is uniformly dark except a narrow middorsal stripe. Gills (see fig. 22) with outer two-fifths dark and a narrower band across the second fifth from the base. Legs (see fig. 23) with two narrow dark bands at apex of femur.

Thus the Satus specimens, as pointed out before, in being an isolated brood of *Archilestes* and perhaps the northernmost outpost of this southern genus, show a racial integrity in the following points: (1) Small size of nymphs and imagoes; (2) lack of metallic coloration; (3) shape of male appendages, and (4) coloration of nymphs.[1]

2. A NEW SPECIES OF DRAGONFLY OF THE GENUS ARGIA, ITS LARVA AND THE LARVA OF ARGIA VIVIDA.

On July 31, 1910, while collecting along the Yakima River near the Mabton Bridge, I took for the first time several pairs of a large *Argia*, the males of which were of a rich violet color. At this point the river was shallow, muddy bottomed, and stagnant. The Argias, in company with *Enallagma cyathigerum*, *Ischnura perparva*, and *Ischnura cervula*, were flying about and resting on a small patch of *Potamogeton*. I tried at first scooping them with my net in order to keep the net dry, but failed. Success came only when they were slapped into the water, potamogeton, net, and *Argia*. My first meeting with them showed that they were quick, nervous, and unusually wary.

I saw no others until August 13, 1911, when I found them very abundant on the gravelly beaches and stony riffles of lower Satus Creek. It was soon evident that on gravelly ground it was practically impossible to catch them, as the uneven surface of the gravel permitted them to dodge under the edge of the net. During the two hours I had at my disposal for collecting, I succeeded in taking less than a dozen specimens, though they were very abundant.

None were collected during 1912, but during the past summer (1913) I managed to carry out an extended campaign of collecting on Satus Creek, making 11 trips, though the creek is 18 miles from the ranch.

Satus Creek drains that part of the Yakima Valley which lies between the Simcoe Mountains and the brown, barren Horse Heaven

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[1] Just recently in San Jose and at Napa, California, I have had opportunity to observe the live *Archilestes* nymphs. They are very free swimmers, and on being disturbed swim into the open water like a school of minnows, which I thought they were when I first saw them. This habit accounts for my failure to capture any by raking. Emergence had just begun at Napa on June 9. Here the nymphs were very abundant in the ponds on the State Hospital grounds.

Hills. This is an elevated plateau cut into table-like buttes by the narrow and abrupt canyons of Satus Creek and its tributaries. This arid region slopes rapidly northeast from the Klickitat Mountains on the west to the Yakima River, so that, in its length of 60 miles from the eastern spurs of the Klickitats to the Yakima River, Satus Creek has a fall of about 3,500 feet. This is one of the most arid regions of the Yakima Valley, having an annual rainfall of less than 10 inches, which with its rapid slope makes it so dry that it is a red and brown region with its naked surface but little relieved by the soft gray of sage bushes. Because of this aridity Satus Creek is dependent for its water on the melting snows of the Klickitat Mountains, which give it a flood in May and June, while it becomes almost dry from July to October.

The past summer's collecting was done on the lower portion of the creek where Satus Canyon opens out onto the greasewood flats of the Yakima River. The soil of this flat is from 5 to 10 feet deep, below which is gravel. In crossing this flat Satus Creek has cut down through the superficial layer of soil, so that it flows over the surface of the gravel, having thus made an earth-walled channel 200 feet wide, the floor of which is an almost continuous succession of gravel bars. During flood the creek occupies the full width of the channel, but during summer it dwindles to a 10 second-foot stream meandering among the gravel bars of its flood bed. While the greasewood flat is destitute of trees, the creek itself is marked by the green line of willows, elders, alders, and balsam trees, which have gained a foothold on the older gravel bars within the flood channel.

On June 17, 1913, when I made my first trip to Satus this season, I searched carefully for Argias, but found none. The creek was still at a medium stage, being about knee-deep on the riffles, though many of the higher gravel bars were exposed. On June 26 Argias were common, especially on those gravel bars grown up thickly with young willow sprouts, for none appeared at first on the more exposed bars and riffles. Many of these were beyond the teneral stage. At this time there were flying on the creek *Agrion aequabile*, which had been on the wing but a few days, *Enallagma cyathigerum* which was at the height of its season, *Enallagma carunculatum* at the beginning of its season, *Ischnura perparva* common, *Ischnura cervula* less common, *Amphiagrion saucium* scarce and at the end of its season, *Ophiogomphus severus* common and in perhaps the third week of its season, *Ophiogomphus occidentis* rare, *Aeshna californica* at the end of its season, *Aeshna multicolor* common, *Sympetrum madidum* at the beginning of its season, *Erythemis simplicicollis*, *Libellula pulchella*, *Libellula forensis*, and *Plathemis lydia*. On this earliest date the *Argia* males were chasing the females and some were flying around in couple, but I saw none copulating or ovipositing. A month later the species had reached its greatest abundance. The creek then was low; not more than 15 second-feet of water was flowing. Argias were abundant on the gravel bars and exposed gravel-strewn riffles, and among the pink willow roots oviposition was in progress. On August 8 the *Argia* was yet the most abundant species, but by August 24 the number was less than one-fourth its previous maximum. On September 7 only two Argias were seen, and on September 14 none were found. Its season had ended as the autumnal species were reaching their height, *Archilestes californica, Lestes congener, Ischnura perparva, Aeshna palmata, Aeshna umbrosa occidentalis,* and *Sympetrum vicinum* being the only species on the wing. Some individuals emerged as late as August 7, though none were noticed on later dates.

The following is a description of this *Argia,* which was found to be undescribed and which I have named for my mother, who has ever encouraged my interest in entomology.

ARGIA EMMA, new species.

Figs. 27–30, 35–36, 39–41, 48, 50–51, 54–61, 65–70.

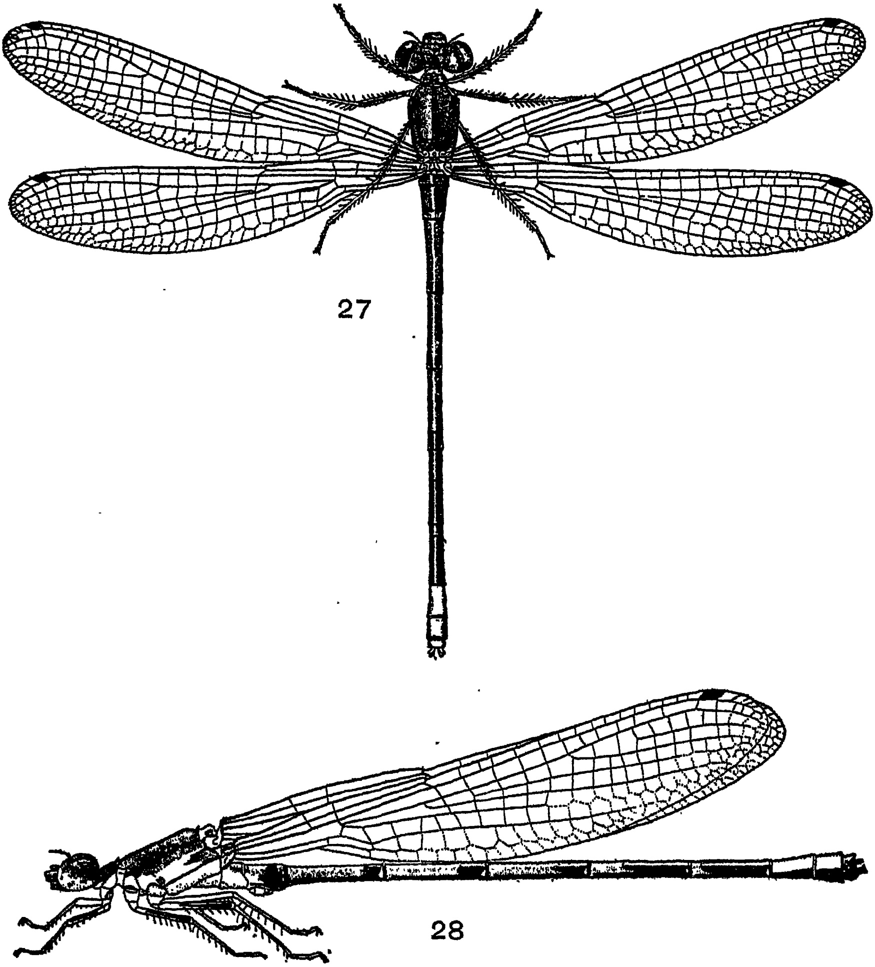
This is a large species of *Argia,* but is not as robust as *Argia vivida.* It is a species not brilliantly marked, and is comparatively free from pile.

Length of abdomen: Male, 27–31 mm.; average, 29.1; female, 27–32; average, 29.35. Length of hind wings: Male, 21–24; average, 22.75; female, 22–25; average, 23.2.

Type.—Cat. No. 19038, U. S. N. M. A male, from Satus Creek, Yakima County, Washington, August 7, 1913.

Allotype.—Cat. No. 19038, U. S. N. M. A female from Satus Creek, Yakima County, Washington, August 7, 1913.

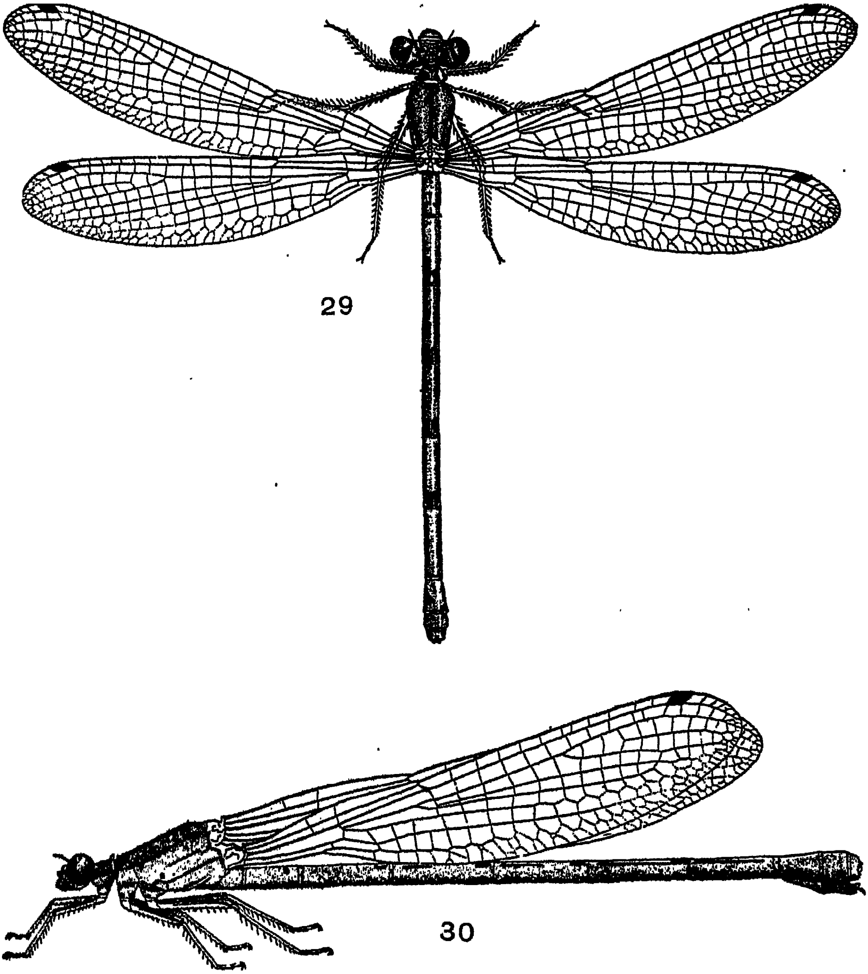
Male.—Thorax robust, abdomen slender. Legs long, the last femora reaching to the second abdominal segment. Wings noticeably narrower than in the female, and in the fully colored specimens with a faint bluish or steely sheen. Stigma surmounting only one cell, which is usually larger than the stigma. Among 20 males tabulated; the usual number of antenodal cells was 4 in each fore wing and 3 in each hind wing. Variations of one or two occurred either way. The average for the fore wings in the 20 examples was 3.9 and for the hind wings 3.3. The male illustrated in figure 27 was not included in the 20 tabulated. In the accessory genitalia are peculiarities which are probably specific. (See figs. 50 and 51.) The ventral limb of the anterior hamuli, i. e., the horizontal ventral edge, is high and thin compared with the same in *vivida,* where it widens cephalad. The posterior hamuli are rounder, when viewed ventrally, than in *vivida.* The most marked peculiarities occur in the penis, which in this species is very simple. It consists of a long chitinized proximal joint folded on itself, which carries at its distal end two lateral fleshy lobes, which are thin dorso-ventrally. Arising between the distal ends of these and curving ventrad and cephalad, then dorsad, is the curved tip of the penis, which is supported by two chitinous ribs. This tip, as compared with the complexly lobed tip of the *vivida* penis, is simple in construction. The lateral walls of the genital fossa, when viewed from the side, are almost straight, when compared with the abrupt ventrad development of the posterior half of the walls in *vivida*.



FIGS. 27-28.—ARGIA EMMA, MALE. 27. DORSAL VIEW. 28. LATERAL VIEW.

Segment 10 of the abdomen deeply and narrowly indented on the median dorsal line of the posterior end, and with a high keel on either side of this indentation. (See figs. 39–40.) The superior appendages

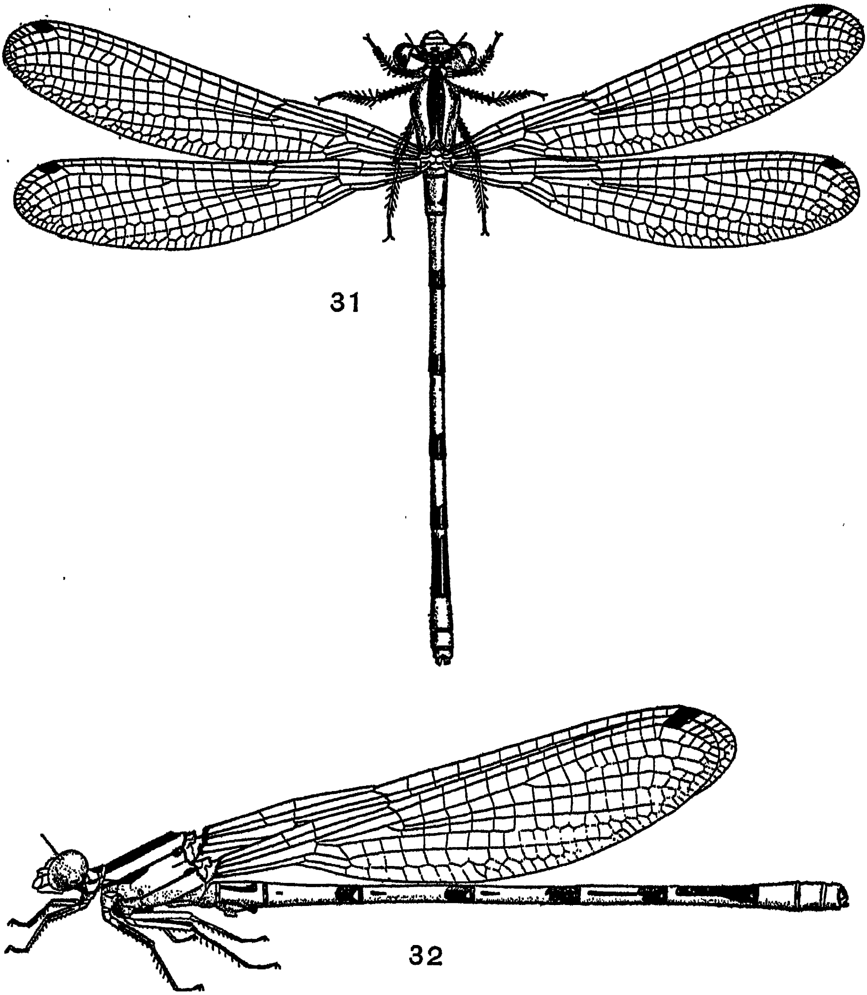
two-thirds the length of the inferiors; when viewed from above, each is curved inward for its first half, then *rounded outward,* and terminates in two short points, both of which lie in the same horizontal plane, and are directed laterally. The superiors when viewed laterally show the distal end terminating in a blunt point directed ventrad.



FIGS. 29-30.—ARGIA EMMA, FEMALE. 29. DORSAL VIEW. 30. LATERAL VIEW.

In the inferior appendages the distal branch is short and rounded, and, when viewed from above or below (figs. 40–41), is seen to be decurrent on the inner edge of the appendage as an ill-defined ridge. The other or lateral branch, when viewed from above or below, is semicircular in outline, and is directed caudad and laterad at an angle of 45° and when viewed from behind is seen to be directed upward at an angle of 45°. It has an obscure rounded tooth on its outer anterior edge. Some pile occurs on the appendages but not enough to obscure them. The minute spines on the posterior edges of the segments are long as compared with the short blunt spines of *vivida*.

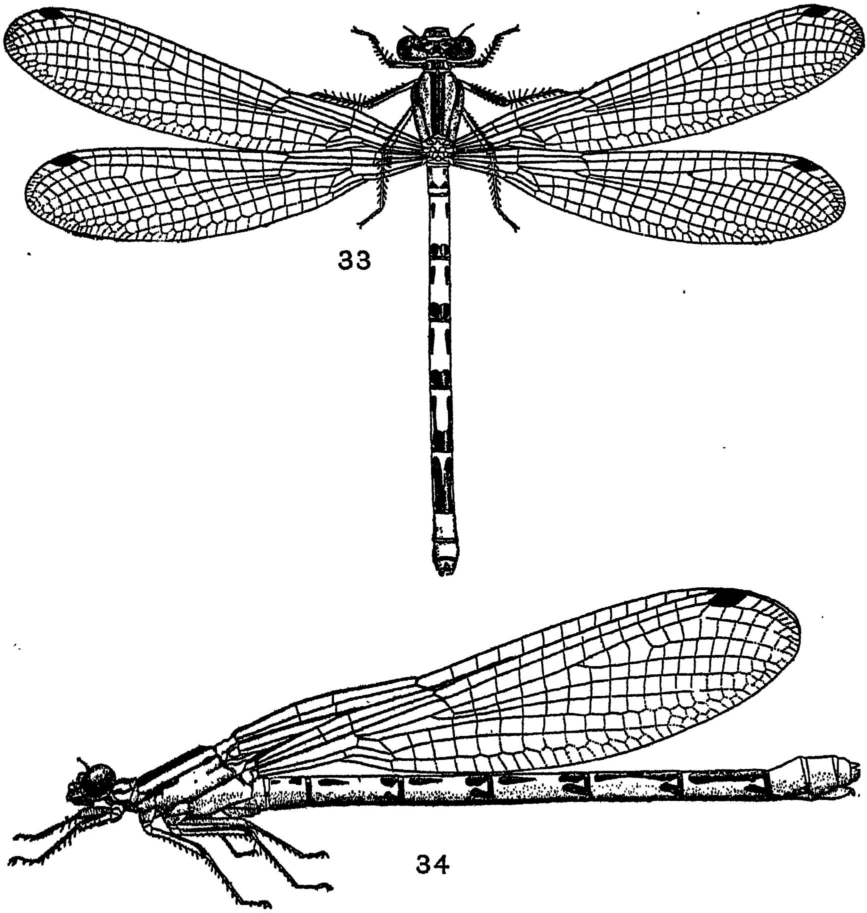
In Doctor Calvert's *Argia* key in Biologia Centrali-Americana, Odonata (p. 72) the species *emma* runs to *funebris*, but it differs sharply from *extranea*, *vivida*, or *funebris* in the shape of the superior abdominal appendages of the male, the apices of which turn *outward* instead of inward. Figure 42 is a tracing from figure 59 of plate 4 of the Biologia Centrali-Americana, Odonata, which was drawn by Calvert from the unique type in the Museum of Comparative Zoology. Figures 43–44 are copies of Doctor Hagen's drawings of the same



FIGS. 31-32.—ARGIA VIVIDA, MALE. 31. DORSAL VIEW 32. LATERAL VIEW

type-specimen of *funebris*, which were published.[1] I have not seen the type myself. I am not well enough acquainted with the genus *Argia* to risk a guess as to whether *emma* falls naturally in the *extranea-vivida-funebris* group or not. The superior appendages of the male seem to exclude it, as do marked differences between the larvae.

In reproducing wings for the illustration, figure 27, I unfortunately reproduced wings which were freakish in that the fore wings have but two antenodal cells each. Furthermore it seems to be the only male in the series so veined.



FIGS. 33-34.—ARGIA VIVIDA, FEMALE. 33. DORSAL VIEW. 34. LATERAL VIEW.

Male, live color.—Labrum, clypeus, nasus, frons, vertex, post-ocular areas, and occiput rich violet. Gena lighter, almost pink. Ocelli brownish. Antennae black. A black line connecting each antenna with the anterior ocellus. (See figs. 55–57.) A T-spot extending forward from the anterior ocellus. The ocellar area and the area between the ocelli and the vertico-occipital suture black. Suture between either end of the occiput and its postocular area black. From each anterior angle of the occiput a black line extending forward to its corresponding antenna, and a narrow line extending laterally to its corresponding eye. Postocular areas edged posteriorly with black. Labrum, clypeus, frons, and occiput covered with long white pile, which is longest on frons. Eyes very dark violet above, almost black, shading into grayish violet below. Under surfaces of head pale violet, covered with scattering white pile.

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[1] Calvert, P. P. Illustrations of Odonata: Argia. By Hermann A. Hagen. Bull. Mus. Comp. Zool., vol. 39, No. 4, pl. 1, figs. 4-4*a*, November, 1902.

Prothorax violet above. Sides and coxae brownish with a heavy coating of pruinose. The tergo-pleural sutures black; a broad black line at the base of the posterior lobe connecting the posterior ends of the tergo-pleural lines; a black line along base of anterior lobe connecting the anterior ends of the tergo-pleural lines. Anterior edge of anterior lobe black. A narrow longitudinal middorsal violet stripe bounded on each side by a black stripe. Posterior lobe not marked.

Mesothorax and metathorax with dorsal surfaces violet, shading into brownish on lower-lateral and ventral surfaces; the brownish areas heavily pruinose. Middorsal carina narrowly black, one-fourth width of either antehumeral pale streak, the black extending around the edges of the antealar sinuses. Dorsal third of mesinfraepisternum black. Humeral suture black, as follows: A rectangular black spot below its anterior end, from which a broad line extends dorsad to its middle point, where it tapers to one-third its previous width, extending thus narrowed to the dorsal fourth, where it abruptly widens for the remainder of the suture. Dorso-posterior edge of mesepimeron and upper third of first lateral suture black. Dorso-posterior edge of metepisternum and second lateral suture black. Femora pale brown with a heavy external and a heavy anterior black stripe, between which lies a high brown keel. Tibiae with an antero-interior black stripe. Spines black. Tarsi dark brown. Wings hyaline, stigma dark brown.

Abdomen with segments 1–7 violet with black sterna; segments 8, 9, and 10 blue with black sterna, and abdominal appendages black. (See figs. 27 and 28.)

Segment 1 with sides and sternum brown overlaid with pruinose.

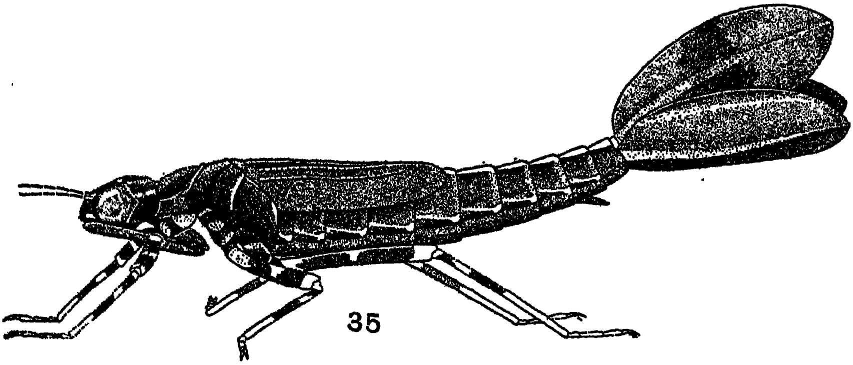
Segment 2 with a lateral round-lobed, inverted T-spot on the posterior half, followed by a narrow band encircling posterior end.

Segment 3 with a narrow line along ventral edge of pleurite. A narrow band around posterior end, just in front of which is a second broader band encircling the segment, but running obliquely down and forward.

Segment 4 marked similarly to segment 3, but with the broad oblique band occupying the posterior fourth of the segment.

Segment 5 similar to segments 3 and 4, but with the broad band occupying the posterior third of the segment.

Segment 6 similar, but with the broad band occupying the posterior half of the segment.



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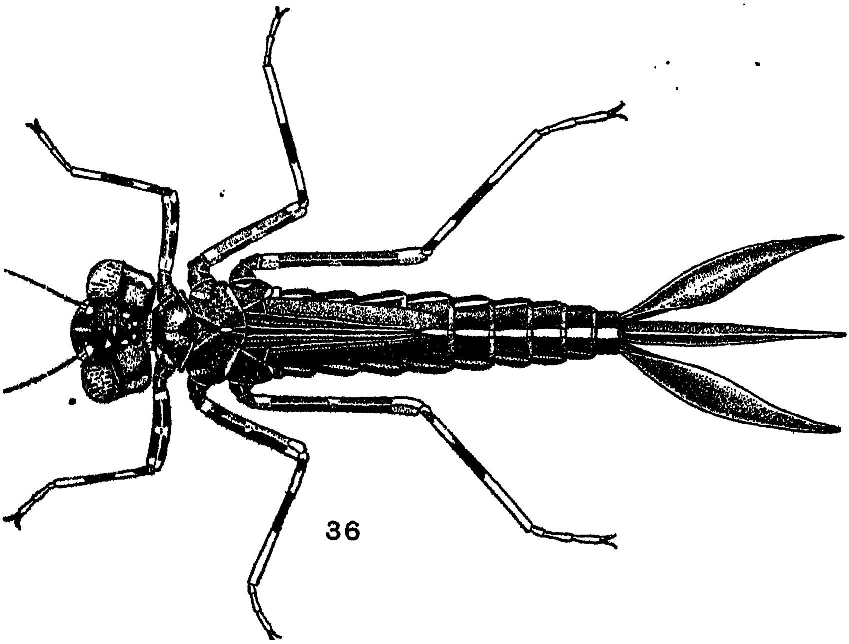

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FIGS. 35-36.—ARGIA EMMA, NYMPH. 35. LATERAL VIEW. 36. DORSAL VIEW.

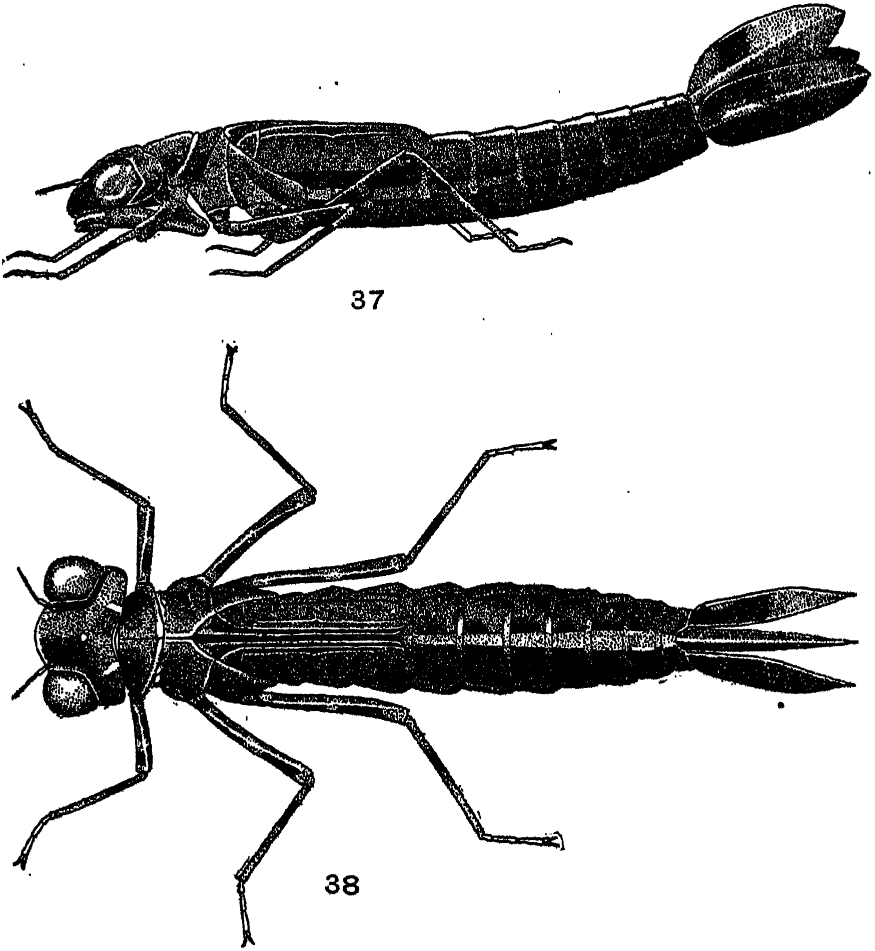
Segment 7 similar, but with the broad band occupying the posterior three-fourths of the segment. In segments 6 and 7 the anterior edge of this broad band shades out so that the anterior edges lack definition.

Segments 8 and 9 blue with a black stripe along ventral edge of pleurite, wider on segment 9 than on segment 8.

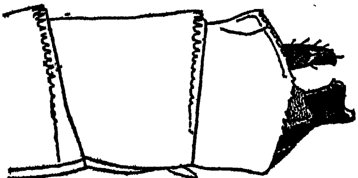
Segment 10, upper half blue, lower half black, the dividing line running ventrad and anterad. Appendages black, lighter around bases and on inner surfaces of inferiors.

The teneral is a cream or light tan color. It changes through light brown into a light brownish violet, and finally into violet; later the under parts become pruinose.

Female.—Slightly larger than the male, and especially the abdomen more robust. Wings slightly longer. Among 20 females tabulated the tendency in number of antenodal cells was to a slightly greater number than in the male. Two of the 20 had 5 cells in each fore wing and had 4 cells in each hind wing. The averages were, right fore wing 4.1, left fore wing 4.1, right hind wing 3.6, left hind wing 3.4. Legs long, the femora of the anterior pair reaching the second abdominal segment. The best diagnostic character is the shape of the mesostigmal laminae, the minute organs on either side of the anterior end of the middorsal carina, which appear to have a form peculiar to the



Figs. 37–38.—Argia vivida, nymph. 37. Lateral view. 38. Dorsal view.



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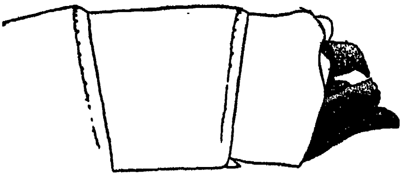

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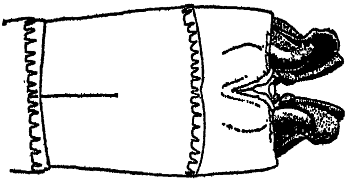

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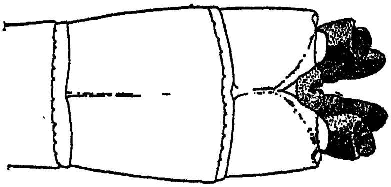

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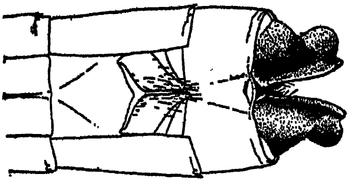

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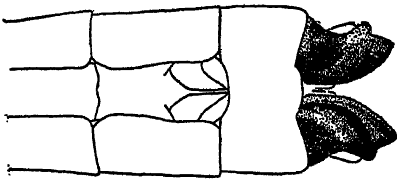

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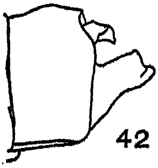

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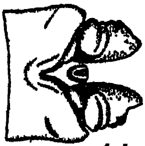

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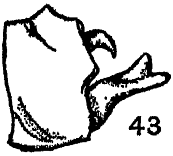

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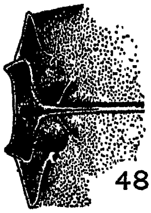

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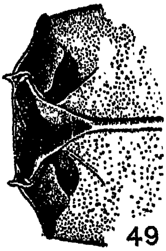

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FIGS. 39-41.—ARGIA EMMA, ABDOMINAL SEGMENTS 9 AND 10. 39. LATERAL VIEW. 40. DORSAL VIEW. 41. VENTRAL VIEW.

FIG. 42.—ARGIA FUNEBRIS, MALE ABDOMINAL SEGMENT 10, LATERAL VIEW, COPIED FROM CALVERT.

FIGS. 43-44.—ARGIA FUNEBRIS, MALE ABDOMINAL SEGMENT 10, COPIED FROM HAGEN. 43. LATERAL VIEW. 44. DORSAL VIEW.

FIGS. 45-47.—ARGIA VIVIDA, MALE ABDOMINAL SEGMENTS 9 AND 10. 45. LATERAL VIEW. 46. DORSAL VIEW. 47. VENTRAL VIEW.

FIG. 48.—ARGIA EMMA, FEMALE, MESOSTIGMAL LAMINAE.

FIG. 49.—ARGIA VIVIDA, FEMALE, MESOSTIGMAL LAMINAE.

females of each species of *Argia*. By referring to figure 48 it will be seen that the whole organ (formed of the anterior end of the middorsal carina and the two laminae) is narrow antero-posteriorly, that the middorsal carina ends in it abruptly, instead of widening out into a broad triangle as in *vivida*, and that the two postero-lateral depressions are less sharply defined than in *vivida*. The minute spines on the posterior edge of the abdominal segments are long and slender as in the male.

Female, live color.—In some females in advanced age the color is a slate blue. Tenerals are as in the male (see figs. 60 and 61), a light tan or creamy white, changing then through darker shades of brown to olive, and in some specimens, perhaps 5 per cent, of those captured to a further stage of slate blue. In drying, the blue specimens change to an olive brown. The females may be dichromatic, as both blue and brown females oviposit.

Female, blue form.—Labium and labrum brownish gray; clypeus, nasus, frons and vertex, bluish slate. Postocular areas pale gray. Under surfaces of head brownish. Eyes grayish brown above and whitish below. Head sparingly covered with white pile. Markings on the head same as described for male, and showing the same individual variation.

Prothorax bluish slate above, brownish on the sides, and heavily pruinose below. Markings same as described for the male.

Mesothorax and metathorax strikingly blue on anterior and dorsal surfaces, also on sides to below humeral suture. Lower sides and ventral surfaces pale olive brown overlaid with pruinose. Legs light brown and pruinose, less heavily striped than in the male. All other thoracic markings same as described for the male. Wings hyaline, lightly flavescent in some individuals; stigma cream.

Abdominal segment 1 pruinose. (See figs. 29 and 30.)

Segment 2 blue with an olivaceous cast. A narrow black ring around its posterior end. Two small oval spots on the dorsal surface of the posterior third.

Segment 3 very blue, the bluest of the abdomen. A narrow black ring around its posterior end. On either side a narrow oblique spot running ventrad and caudad in the extreme ventro-posterior angle of the pleurite. On the posterior end of the dorsal surface a U-shaped spot opening cephalad.

Segment 4 less blue than segment 3. As in segment 3, a narrow band around the posterior end, and a narrow oblique spot running ventrad and caudad in the angle of the pleurite. A narrow stripe, broader cephalad, running along either upper side. These stripes[1] begin from the anterior end of the segment at about twice the width of the posterior bands, and terminate at the middle of the segment. On the posterior end of the dorsal surface a U-shaped spot, but with the arms of the U so broad that the internal opening is reduced to a line, while the external anterior angles of the arms of the U are rounded.

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[1] These stripes are termed by Calvert in the Biologia Centrali Americana. "post-basal streaks."

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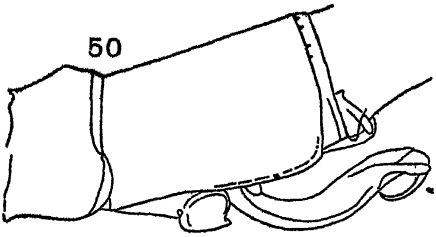

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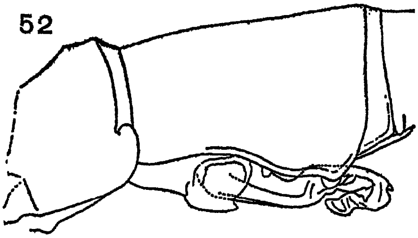

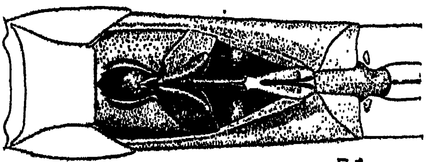

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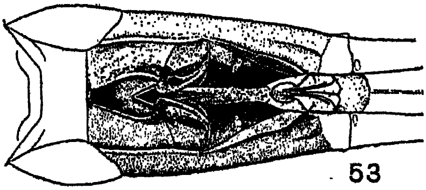

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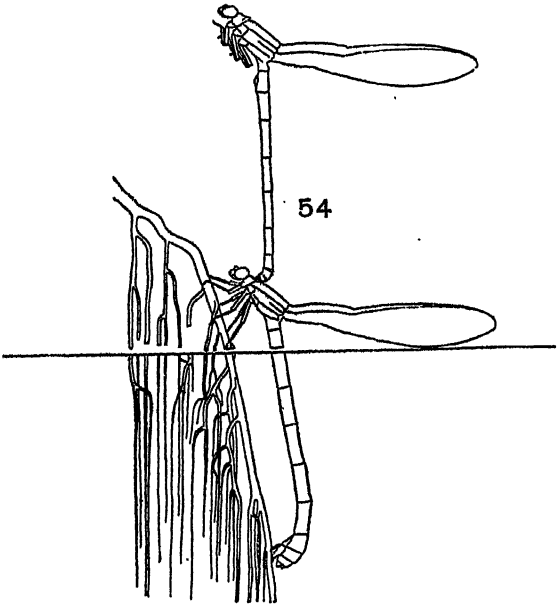

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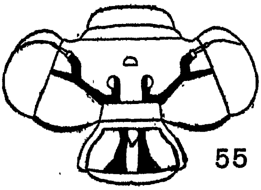
FIGS. 50-51.—ARGIA EMMA, MALE ABDOMINAL SEGMENTS 1 AND 2. 50. LATERAL VIEW. 51. VENTRAL VIEW.
FIGS. 52-53.—ARGIA VIVIDA, MALE ABDOMINAL SEGMANTS 1 AND 2. 52. LATERAL VIEW. 53. VENTRAL VIEW.
FIG. 54.—ARGIA EMMA, OVIPOSITING.

Segment 5 less blue than segment 4, but with the same color pattern.

Segment 6 olivaceous. Color pattern same as in segments 4 and 5, but with each dorso-lateral stripe confluent posteriorly with its arm of the dorso-posterior U-spot.

Segment 7 a medium brown color. Color pattern similar to that of segments 4, 5, and 6, except that the dorso-posterior spot is wanting, and the two dorso-lateral stripes extend caudad to the posterior fifth of the segment.



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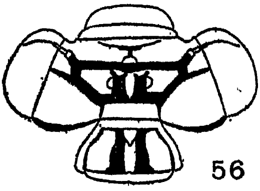

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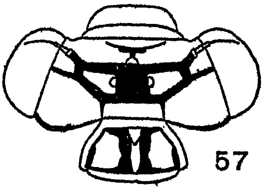

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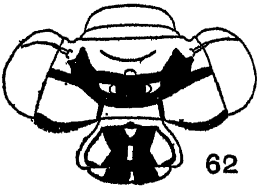

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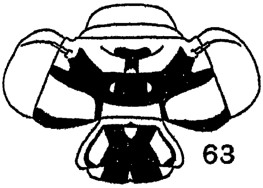

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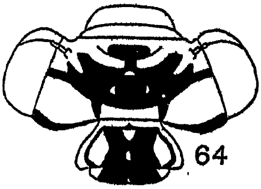

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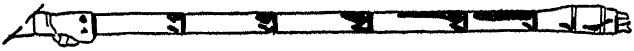

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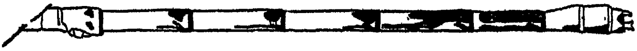

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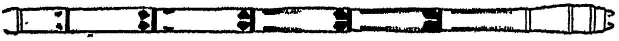

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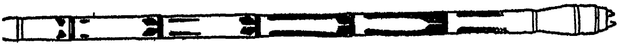

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FIGS. 55-61.—ARGIA EMMA. 55-57. MALE, MARKING ON HEAD AND THORAX. 58-59. MALE, MARKING ON ABDOMEN IN TENERALS, LATERAL VIEW. 60-61. FEMALE, MARKING ON ABDOMEN IN TENERALS, DORSAL VIEW.

FIGS. 62-64.—ARGIA VIVIDA, MALE, MARKING ON HEAD AND THORAX.

Segments 8, 9, and 10 a medium brown with no markings.

Ventra of segments 3–8 black, of segments 1, 2, 9, and 10 brown.

Female, brown form.—The larger number of females are of this color, which is as follows: Labium and labrum gray; clypeus, nasus, frons, and vertex pale reddish brown. The postocular areas the most reddish of any part of the insect. Eyes pale brown above, brownish gray below. Antennae black.

Prothorax pale brown above, lighter below. Legs pale brown.

Mesothorax and metathorax yellowish brown on dorsal and anterior surfaces. Coxae and trochanters same shade, femora and tibiae pale brown. Wings hyaline, stigma almost white.

Abdominal segments 1–7 brownish olive gray, shading into brownish on segment 8. Segments 9 and 10 pale grayish brown.

All markings same as described for the blue female.

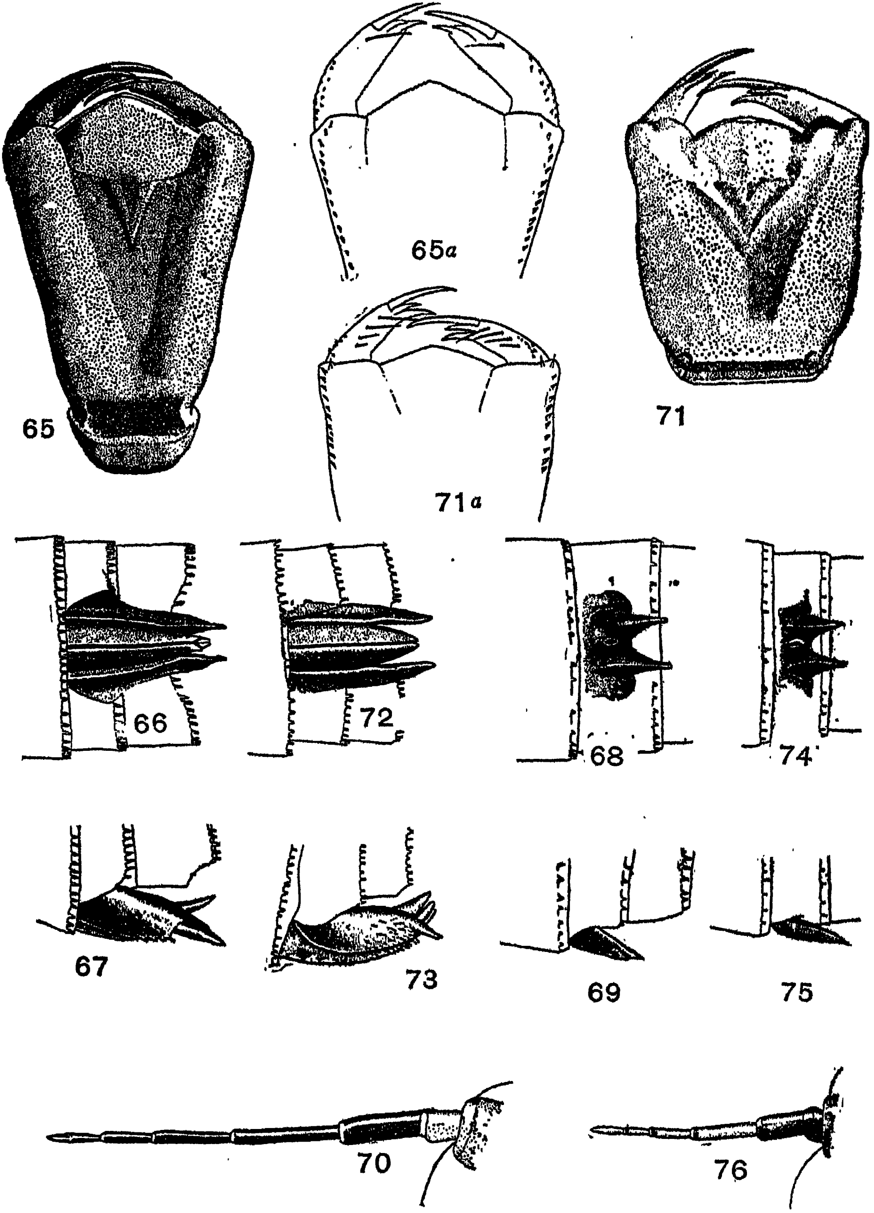
The system of markings in *Argia* seems to be a generic character, as it occurs with various modifications from sex to sex and species to species. The more generalized pattern occurs on the females (see figs. 29, 30, 33, 34, 60, and 61). The coloration of the males is more widely divergent, but is understood when its evolution from the "female form" in the male teneral is considered (see figs. 58 and 59, of male teneral *emma*).

Nymph (figs. 35, 36, 65–70).—This is a vigorous, long-legged and contrastingly colored nymph with large gills.

Length of abdomen, without gills, 12 mm.; length of gills, 5; width of head, 3.5; length of hind leg, 11. The specimens are shrunken from having been put into strong alcohol.

Head broader than long, the posterior margin noticeably emarginate. Five round white dots between the compound eyes (the 3 ocelli and 2 other similar white dots). A broad white stripe on each postocular lobe. Antennae longer than head, slender, base and first joint white, the remaining joints black. Mentum 1½ times as long as broad; posterior edge one-half as wide as anterior margin; ligula angular. Each lateral lobe with a single raptorial seta just below the base of the movable hook, a notch separating the end hook from the inner margin.

Prothorax more than twice as broad as long, the ridge around the posterior edge very prominent, and running down on to the side to the coxae. Dorsal surface strongly convex with a median groove. Femora of first pair of legs three-fourths as long as femora of second pair. Mesothorax and metathorax equal and either slightly longer than the prothorax. A deep concavity extending from anterior point of anterior wing pads to mesinfraepisternum. Femora of second legs extending beyond the posterior margin of abdominal segment 4. Tubercle between the upper edge of mesinfraepisternum and posterior edge of prothorax drawn out dorso-ventrally, making a low vertical ridge. Posterior pair of wing pads extending to posterior edge of abdominal segment 4. Femora of last pair of legs extending to posterior side of segment 5.



Figs. 65-70.—Argia emma, nymphal detail. 65. Labium, ventral view. 65a. Labium, dorsal view. 66-67. Vulva. 68-69. Abdominal segment 9 of male. 70. Antenna.
Figs. 71-76.—Argia vivida, nymphal detail. 71. Labium, ventral view. 71a. Labium, dorsal view. 72-73. Vulva. 74-75. Abdominal segment 9 of male. 76. Antenna.

Abdomen dark, with a white middorsal stripe, narrower anteriorly and widening caudad until widest on segments 9 and 10, where it is bordered on each side with intense black. A low lateral keel on segments 1–8 (not conspicuous on segments 7 and 8). A narrow, jogged white stripe dorsad of either lateral keel. The lateral gills are very spoon-shaped and in fresh material variously banded with black.

Male with the two points on the sternum of segment 9 slightly longer and more attenuate than in *vivida.* (See figs. 68–69.)

Female with the two outer or ventral members of the ovipositor shorter than the dorsal or inner pair. (This is true also in *vivida,* but only for the immature nymphs.) The genital valves, especially the posterior points, vary greatly in shape. In this species they are usually conspicuously toothed, especially on the distal half of the ventral edge. (See figs. 66–67.)

Male, a skin collected August 3, 1913, on Satus Creek, Yakima County. (On the same date I collected a male in the act of emerging, but the skin blew into the water, damaging it too much for a type specimen.) Deposited in the United States National Museum.

Female, collected on Satus Creek, June 29, 1913, reared, emerging between July 2 and 10, while I was in Oregon, during which time the teneral drowned, being badly decayed on my return. Skin and imago deposited in the United States National Museum.

About 20 specimens, including both skins and nymphs, were collected during 1913. The nymphs of this species are not easily found, as they roam over the whole creek bed and so are never numerous in any single place. They are usually found in the roots and brush of the larger pools and under large stones on the riffles. On turning a stone over the nymph is usually on the bottom beneath the stone and hurrying away. This is a noticeable difference between this nymph and that of *vivida,* which is usually hanging back down from the stone picked out of the water, and very sluggishly arouses to the fact that it should hunt shelter. The agility of the *emma* nymph permits it to live in the swift riffles and contest for existence with the crayfish and stonefly and mayfly nymphs. It is the only odonate nymph found in the swift riffles of Satus Creek.

Emergence, judging from the finding of tenerals, takes place any hour of sunlight after the middle of the morning. The nymph usually crawls up on a stone, seldom more than an inch above the water. On August 3, 1913, I found an *Argia* emerging. It had crawled up on to a smooth pebble lying in the middle of a shallow riffle, where I found it at 9.52 in the morning an inch above the surface of the water, with head, thorax, and legs already withdrawn. It was clasping the head of the skin with its frail feet. It was a grayish cream color. In a minute it moved its legs in a tentative manner, then quickly crawled up on the stone just in front of the head of the skin, but with the tip of the abdomen still retained in the skin. In a minute more it crawled farther up the stone, freeing the tip of the abdomen, and continued to move about with nervous, jerky steps.

At 9.55 it was twice the length and size of the skin, and the wings had begun to lengthen. In the lengthening of the wings the bases lengthened first and the tips last. The wings were then three-fourths of an inch long, increasing in two minutes more to five-eighths, and were clear except the costal margin beyond the nodus. All during emergence the teneral rapidly and incessantly moved the body up and down. At 9.59 the wings were 1 inch long, and in another minute were clear. The abdomen during expansion of the wings remained the same length as when first withdrawn, but at 10.04 it began to lengthen, the expansion beginning with the anterior segments; at 10.09 the abdomen equaled the wings; at 10.12 it was one-fourth inch longer than the wings. At 10.15 the teneral, still a grayish cream color, crawled nervously to the top of the stone and flew weakly to a willow 30 feet distant. In two minutes after the teneral had withdrawn its abdomen from the skin a light gust of wind had blown the skin into the water. The fact that most of the larvae emerge on the riffles probably accounts for the few exuviae found, as the stones there are round and smooth, permitting the skins to be detached by the first puff of wind.

The teneral stage probably lasts a day or two, during which the insect avoids the opposite sex, and does not trust itself over the surface of the water. Tenerals are usually found in the bushes along the banks.

I have never seen this species hanging in copulation, as is common among Odonata. Its actions are so nervous and rapid that I am not certain that I have ever seen it copulate. From my observation of many pairs I think copulation is as follows: The male in flying about and trying various females finally finds one in a receptive state. As he swoops down on her she flies up, when he seizes her for a second by the head or thorax with his feet, instantly throwing the tip of his abdomen forward and seizing her by the prothorax. If he fills his seminal vesicle during this process he does it the instant before he seizes her prothorax with his abdomen.[1] The very simple structure of the accessory genitalia of segment 2 would indicate rapid action. As the male releases the female from his first or foot grasp and straightens his abdomen the female swings her abdomen forward and apparently copulates for only a second. I have seen several different females swing the abdomen forward for barely a second or so, but am not yet positive that it is a completed copulation. These seizures take place more commonly in the morning. If these seizures are not copulatory, then copulation would seem to take place but once or twice in the life of the female instead of daily and oftener as in the higher Odonata, for if daily I would surely have observed at least some single instance, for I was on the creek early and late and from the beginning of the season watched for copulation. During the afternoon numerous females seated on stones in the riffles refuse the approaches of all males. In refusing a male, the female, as the male swoops down on her, flies up and takes a position just above the male's head, where she flies for several feet until the male gives up and turns away. This species spends many hours in couple, the male holding the female by the prothorax and both seated on some sunny stone.

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[1] In my mind it is a question whether the male dragonfly necessarily fills his seminal vesicle while grasping the female. I have watched for the act of filling the seminal vesicle, but in several years collecting have seen but one instance where I felt sure that I had seen the act. On Sept. 7, 1913, while collecting on Satus Creek, I saw an *Aeshna* (either *palmata* or *umbrosa occidentalis*) swoop at a female flying close alongside a dense thicket and miss her. He then rose vertically a distance of about 12 feet to pass over the thicket, during which rise he had his abdomen bent forward with the ventrum of segment 9 attached to segment 2. He was easily observed because of the dark background of foliage, and because, flying vertically or "back first," he rose slowly. As he cleared the top of the thicket he straightened his abdomen and speeded away. The whole process of filling the vesicle occupied less than three seconds.

Oviposition must occupy but a small part of the time of the female, as on a stretch of 2 miles on Satus Creek I found only one small area where oviposition took place frequently. This was among the pink roots of willows which hung in a shallow side pool through which a small stream flowed. Oviposition is a lengthy process, the female sometimes working alone, but usually held by the male, who supports himself solely by his hold on the female, and, scorning other support, stands stiffly out of the water with his wings folded and his legs drawn tightly against his thorax until the female backing down into the water submerges him with her. (See fig. 54.)

The Argias, while spending all day close to the water, seldom leaving the riffles and bars, leave the water just before sundown and spend the night in the shrubs along the creek, where they are to be found early in the morning. The two ways to capture them with moderate ease is among the bushes early in the morning, or at the height of their season to stand in the water facing a high bank or dense bush, where they are passing, and capture them as they fly past between the collector and the bank or bush.

As to enemies, I have not seen birds capture Argias, but I have seen an *Erythemis simplicicollis* eating a teneral. There are few frogs along the creek; in fact the Argias seem to flourish with few enemies except crayfish and such others as prey on the nymphs. I have never found this species infested with red mites.

I have never found this species else than on the Yakima River and lower Satus Creek.[1]

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[1] Since writing the foregoing I have found *Argia emma* common on the larger rivers of central California and on the Truckee and Humboldt rivers in Nevada. It occurs from sea level on the San Lorenzo and Sacramento rivers to 6,000 feet elevation on the Truckee River at Lake Tahoe. Professor Farr, of Sunnyside, Washington, has recently sent me a series of specimens from Union Flat Creek, Pullman, Washington.

ARGIA VIVIDA Hagen.

Figs. 31–34, 37–38, 45–47, 49, 52–53, 62–64, 71–76.

The second half of this section deals with *Argia vivida* and includes a description of its nymphs. *Argia emma* and *Argia vivida* are the only Argias I have found in the Columbia watershed.

Argia vivida has been found in three localities, all of which agree in certain particulars.

In June I made a four days' drive to the falls of Logie Creek, which is the main tributary of Satus Creek. I succeeded in getting down to Logie Creek in two places and down to Dry Creek, which is the main tributary of Logie, in one place. This is an exceedingly difficult region to explore in a buggy. The single wagon trail runs up hill for 60 miles, following the surface of the ancient slope, with the creeks rushing down through canyons 500 feet below the level of the road.

On June 15 I found *Argia vivida* very abundant on an area of not over an acre in extent about 15 miles above the mouth of Logie Creek. The road at this place went down into Logie Canyon through a short lateral ravine. The bottom of the canyon opened out at this point, making a small flat of about 2 acres in extent, which was covered with grasses, with here and there scrub oak trees, and along the creek its usual line of alders, back from which stretched thickets of rose and sumac bushes. At one end of this flat a spring oozed out at the base of the cliff, and its stream, trickling down through the alder thicket, contained many *vivida* nymphs. The shade, as usual in an alder thicket, was dense, but *Argia vivida* in couple were resting in profusion on the bushes, dead brush, and rocks, which filled this stream. Tenerals were numerous as well as males in high color and a few females in full color, but I saw none copulating or ovipositing. This spring stream was not over 100 feet long, and its bed and sides were of black muck, from the leaves which fall into it annually. Scattered over the bed were rounded stones up to 12 inches in diameter, to the under sides of which the *vivida* nymphs were clinging. The spring water was cold and the nymphs were sluggish. Exuviae were found clinging to the stones but an inch or two above the surface of the water. *Argia vivida* is a comparatively sluggish insect and seemingly very local or restricted in its choice of environment. Argias were very abundant on the ground in the open spaces of the flat near this spring stream, but were not found farther than 150 feet from it. In couple they hung to bushes when hovering about the stream, because the bushes overhung the water, giving them little choice, but outside in the sunshine they sat mostly on the bare ground or on stones or sticks lying on the ground. They were easily taken by approaching carefully and slapping the net over them or scooping them with the net. They were associated here with *Sympetrum madidum* and an *Aeshna*, probably *californica*, which I took on Dry Creek not many miles distant.

I next found *Argia vivida* at Sherman, Oregon, which is on the Columbia River about 2 miles east of the mouth of the Deschutes Canyon. The Columbia Gorge at this point is from two to three thousand feet deep. Its sides are massive brown hills, with here and there solitary green ranches on spring-fed benches a thousand feet above the river. Its bottom on either side is a narrow strip of white sand dunes lying between the gravelly beach and the foot of the hills. Among these sand dunes is the box-car railroad station called Sherman, Oregon. Opening into the gorge about 1 mile west of the station is a narrow canyon, which is occupied by the Y of the Deschutes road. Through this canyon trickles a small stream arising from numerous springs, which meanders in the mouth of this canyon through a succession of swampy and rocky holes. This stream swarms with *Argia vivida.* They sat on the stones along the stream, and because of the numerous rocks, and the heat, were difficult to catch. The constant west wind blowing up the Columbia Gorge had carried many of the Argias as far up as the Sherman station. They were associated in this side canyon with *Amphiagrion saucium* (very abundant), *Ischnura perparva* (common), *Ischnura cervula, Enallagma cyathigerum, Anax junius* (seen on the wing), *Ophiogomphus occidentis* (on the Columbia beach), *Sympetrum corruptum* and *Libellula forensis.*

The third place I found *Argia vivida* was on lower Satus Creek. On August 24, 1913, I took 10 specimens around a scum-covered spring-fed side channel of Satus Creek. This small spot agreed with the other two in being a cold spring-fed but stagnant stream. Perhaps these were descendants of strays from farther up the creek.

Numerous specimens of both sexes from both Logie Creek and Sherman, Oregon, were heavily infested with red mites, in which respect it differs from *emma,* which I have never found infested.

This species differs also from *emma* in that frequently when pursued it will dodge into bushes or other vegetation, where an *Argia emma* would fly for the open.[1]

The following descriptions of the adults are for comparison with *Argia emma.* The color notes are from live specimens and alcoholic material.

DESCRIPTION.

This is a large and robust species of *Argia,* sluggish in comparison with *emma,* and, as its name implies, brilliantly colored.

Length of abdomen: Male, 26–30 mm.; average, 27.8; female, 24–29; average, 27. Fore wings slightly longer than hind wings. Length of hind wings: Male, 20–23; average, 21.7; female, 22–24; average, 23.3.

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[1] Throughout California and Nevada *Argia vivida* occurs in all permanent springs, and while imagoes are occasionally caught on streams and ponds such can usually be traced to near-by spring streams. I have taken it from sea level to 6,000 feet altitude (Lake Tahoe).

Male.—Robust, both thorax and abdomen. Legs compared with *emma* short and weak, the last femora barely reaching the first abdominal segment. Wings relatively shorter than in the female but not noticeably narrower; hyaline but not as steely as in *emma* males. Stigmas variable; among 20 males the stigmas of the front wings in 11 surmount one cell; in 2 individuals the stigma surmounts 2 cells in one front wing and one cell in the other front wing; in 7 individuals the stigmas surmount variously from 1¼ to 1¾ cells. The same variation shows in the stigmas of the hind wings. Among 20 males tabulated the usual number of antenodal cells was 4 in each fore wing and 3 in each hind wing. Variations of one or two occurred either way. The average in the 20 males was right fore wing 4, left fore wing 3.8, right hind wing 3.1, and left hind wing 3.1.

In the second segment of the abdomen (see figs. 52 and 53) the ventral limb of the anterior hamule is thicker anteriorly, and about a third of its length back of the anterior end this thickness forms an obscure ridge decurrent dorsad on the base of the hamule. Viewed ventrally the posterior hamules are more pointed than in *emma*. The ventral limb of the chitinous shaft of the penis has on its ventral surface at the anterior end a ridge, which widens cephalad; the posterior third of the ventral limb is slightly narrower than the anterior two-thirds. The second joint of the penis extends caudad from the distal end of the basal joint or shaft; it is fleshy and widens caudad, and when viewed laterally is seen to be variously folded and ridged. The third or terminal segment runs cephalad; it is supported by two chitinous longitudinal ribs, and consists of an almost quadrangular proximal lobe, occupying two-thirds of its length, each outer distal angle of which is indented on its lateral face, and a distal or terminal elliptic lobe. The lateral walls of the genital fossa when viewed from the side are extended more abruptly ventrad in their posterior half than in *emma*.

Segment 10 deeply and widely indented on the dorso-median line of the posterior end, with a low keel on either side of this indentation. (See figs. 45–47.) The superior appendages two-thirds the length of the inferior; when viewed from above, widening caudad and abruptly truncate, the posterior end appearing impressed. When viewed from behind it is seen that this impressed area is produced ventrad and slightly caudad into a single median tooth. When viewed from the side the dorsal and ventral edges are seen to be subparallel, and the ventro-posterior tooth appears in profile extending ventrad and in some specimens slightly caudad. Each inferior appendage has a lateral and a terminal branch which are subequal. When viewed from above the terminal lobe is seen to be obtusely pointed and when viewed from below it is seen to be decurrent along the inner edge of the appendage as an obscure keel. Lateral lobe extends laterad, dorsad, and slightly caudad, broad but terminates abruptly in a blunt point. Very little pile.

Male, live color.—Labium, labrum, clypeus, nasus and frons light blue. Vertex darker blue with traces of violet. Eyes dark blue above with lighter blue below. Color pattern of top of head same as in *emma*, but with all the lines heavier (fig. 62), in some of the specimens coalescing into a solid spot, as is shown in figures 31, 63, and 64. White hairs on labrum, frons and occipital region. Antennae black.

Prothorax blue above, lighter blue on the sides and with the coxae and ventral surfaces very light A line along the base of the anterior lobe connecting at each end with the line along the upper sides, which lateral lines connect posteriorly with the black line along the base of the posterior lobe. Two broad dorsal lines connecting the anterior and posterior lobes, and extending caudad across the posterior lobe. These lines are separated by a hair line of blue. Trochanters with an outer black spot. (All markings are black unless otherwise stated.) Femora blue with an anterior and an exterior stripe separated by a high pale keel. Tibiae blue with an anterior stripe from which arises the anterior row of spines. Tarsi black.

Mesothorax and metathorax blue, darker dorsally and anteriorly, bluish gray ventrally. A very wide middorsal black stripe, one-third wider than either pale area bordering it. Mesinfraepisternum with its dorsal half black. Humeral suture heavily marked as follows: Lower or anterior half broad, upper or posterior half narrow except an abrupt enlargement at upper end. In occasional specimens the humeral stripe is broad and of uniform width. First lateral suture not marked. Second lateral suture narrowly marked, but with an abrupt, round enlargement at its upper end. Coxae and femora bluish gray, tibiae blue, tarsi black. Markings of middle legs similar to those in the fore legs but not as heavy and yet lighter in the hind legs. Wings hyaline, neither bluish nor flavescent. Stigma dark brown.

Abdomen with segments 1–7 intense blue above with sternum of segment 1 brown and sterna of segments 2–7 black. Segments 8–10 lighter blue with brown sterna. Markings as follows (see figs. 31 and 32):

Segment 1 with minute lateral black spot on its posterior edge.

Segment 2 with a narrow band around its posterior end. On either side above, a narrow stripe almost the length of the segment, with the posterior end turning dorsad.

Segments 3, 4, and 5 marked as follows: A broad band around the posterior end of the segment. A small spot above on either side of the anterior end of the segment.

Segment 6 similarly marked, but with either anterior spot connected with the posterior band by a line running caudad. (In some specimens segment 6 is marked similarly to segments 3, 4 and 5.) The posterior bands contain on either side a blue triangle.

Segment 7 with a heavier development of the color pattern than on segment 6, making the entire dorsal half of the segment black except a narrow blue band across the anterior end.

Segment 8 pale blue with a minute spot on each latero-posterior edge.

Segment 9 pale blue with posterior edges and appendages variously marked with black.

The teneral color of the male is a pale gray or chalky white. In changing from the chalky white to the intense blue the male passes through brown, brownish violet, and violet blue stages.

Female.—More robust than the male, especially the abdomen. Wings relatively longer than in the male, which when folded reach to the middle of segment 8 and occasionally to middle of segment 9; hyaline but with a decided flavescence. Stigma rarely surmounting more than one cell. Wings not proportionally broader than in the male. Among 20 females tabulated, the usual number of antenodal cells was 4 in each fore wing and 3 in each hind wing, with variations of one either way. The average in the 20 females was, right fore wing 3.9, left fore wing 4, right hind wing 3.1, and left hind wing 3.1.

Legs short, the last femora reaching the first abdominal segment. Mesostigmal laminae large (see fig. 49); the anterior end of the mid-dorsal carina prolonged between them into a wide triangular enlargement, and each mesostigmal lamina extended posteriorly in a plate or ridge, which overhangs its respective postero-lateral depression.

Female, live color.—The females of *Argia vivida* are more variously colored than any sex of any odonate species I have seen. As in the male, the teneral is a chalky white, which changes through various shades of gray-violet and brown into a high color largely blue, which gives the female the general appearance of the male in high color. This blue color was rare, as I found few specimens in it, but I took most of my *vivida* series early in their season. Of four females taken on lower Satus Creek on August 24, only one was blue.

Female, blue form.—Labium brownish gray; labrum grayish blue; clypeus, nasus, frons and vertex greenish blue slate. Occiput and postocular areas blue with a tinge of violet. Markings of the head same as described for the male with the same individual variations. Eyes blue above, shading into violet gray below (in one high colored female my notes mention, "eyes violet gray"). Scattering white pile on the labrum, frons and nasus, also on the postocular areas and occiput. Antennae black.

Prothorax with dorsal and lateral surfaces blue; ventral surface and coxae pale brownish; femora gray; tibiae pale grayish blue. All markings as in the male.

Mesothorax and metathorax blue, more intense on the anterior surfaces, shading into violet gray on sides and under surfaces. Coxae and femora violet gray; tibiae greenish blue. Legs and thorax marked as in the male. Stigmas pale brown. Wings hyaline with a suggestion of flavescence; stigma brown.

Abdomen, ground color blue, an intense blue on dorsal surface shading into a more violet blue on the sides of segments 1–7. Sternum of segment 1 brown and of 2–7 black. Dorsal and lateral surfaces of segments 8, 9, and 10 pale blue. Markings as follows (see figs. 33 and 34):

Segment 1, on either side a minute spot at the posterior end.

Segment 2 with a narrow black band around posterior end. At anterior end a small spot above on either side. At posterior end a larger spot, triangular (sometimes quadrangular or even elliptic) above on either side.

Segment 3, a narrow band around the posterior end. At the anterior end above on either side, a small spot attenuate caudad. At the posterior end a larger spot on either side, but with the inner anterior angles coalesced across the middorsal line, and the posterior ends touching the posterior band. (These large paired posterior spots are homologous with the U-spots on the abdomen of the *emma* females.) In each lower posterior angle of the pleurite an oblique stripe running dorsad and cephalad for one-fifth the length of the segment.

Segments 4 and 5 marked like segment 3, but with the markings successively heavier until in segment 5 the two posterior dorsal spots are coalesced into a heart-shaped mark with the apex pointing caudad.

Segment 6 marked like segment 5, but with the two antero-dorsal spots attenuate caudad until their posterior ends coalesce with the anterior points of the heart-shaped postero-dorsal marking.

Segment 7 with markings similar to the preceding, but with the four dorsal spots enlarged and coalesced into a large V-marking, which when viewed from above resembles an old fashioned clothespin with the head pointing caudad.

Segment 8 with a minute spot in the lower posterior angle of the pleurite.

Segments 9 and 10 without markings.

As stated previously, the teneral ground color is a chalky white. The first change is to a brownish violet along the dorsal surface of the abdomen. Then the eyes become grayish violet and segments 8, 9, and 10 become pale blue. The chalky gray of the entire body then takes on a pale brownish tint with suggestions of violet on the abdomen and femora. The majority of the females collected were in this violet and brown stage with segments 8, 9, and 10 blue, which I believe is the usual breeding color.

Nymph.—(figs. 37, 38, 71–76).—A short nymph with very dark color, and color pattern very obscure except the broad white stripe down the middorsal line of the abdomen. Caudal gills small and legs weak.

Total length, not including gills, 12 mm.; length of abdomen without gills, 7; length of gills, 3; width of head, 3.6; length of hind leg, 7.5. Head broader than long, the posterior margin almost straight, being very slightly emarginate between the postocular lobes. Antennae (see fig. 76) short, their length less than length of head; base and first two joints black, the four distal joints white with obscure darker rings. (These markings fade very soon in alcohol.) Mentum short and broad, almost square; anterior margin of ligula slightly convex. Four raptorial setae on each lateral lobe, the anterior setae as long as the end hook, the others successively shorter. The end hook is not separated by a notch from the inner margin as in *emma*. (See figs. 71 and 71*a*.)

Prothorax twice as broad as long. Ridge around posterior edge not prominent. Dorsal surface flat except a minute semicircular depression on the anterior portion. Femora of first pair of legs two-thirds as long as femora of second pair. Tibiae of first pair almost as long as tibiae of second pair.

Mesothorax and metathorax equal and either slightly longer than the prothorax. A deep concavity extending from the anterior point of the anterior wing pads to the mesinfraepisternum. A short tubercle between the upper edge of the mesinfraepisternum and the posterior edge of the prothorax. Posterior wing pads extending to the posterior edge of abdominal segment 3. Femora of last pair of legs extending to middle of segment 4.

Abdomen widest in segments 4 and 5 which are only slightly less wide than thorax. A low lateral keel on segments 1–7 (inconspicuous on 7). Abdomen very dark, with a very conspicuous white middorsal stripe, which is narrow cephalad and widens caudad until it is widest on segment 9 (all other abdominal markings obscure). The middorsal stripe bordered by dark. A light irregular stripe associated with each lateral keel, which is edged above and below by darker. The lateral gills less conspicuously spoon-shaped than in the *emma* nymph, the prominent rib making them more roof shaped.

In the male the two points on the abdominal segment 9 are shorter and more pyramidal than in the *emma* male. (See figs. 74, 75.)

Female with the two outer or ventral members of the ovipositor as long or longer than the upper or inner pair (except in immature larvæ). The genital valves roughened on the distal half of the ventral edge, any teeth being hidden by long hairs. The posterior tips of the genital valves vary greatly, not giving reliable characters. (See figs. 72–73.)

Of the two nymphs, *vivida* is covered with a fine pubescence, while *emma* larvae are almost entirely free from pubescence.

Described from a male, collected June 15, 1913, on Logie Creek, Yakima County, Washington; reared, emerging June 25, 1913; skin and imago deposited in the United States National Museum. Also described from a female, an alcoholic nymph collected June 15, 1913, on Logie Creek, and now deposited in the United States National Museum.

The only place I have collected *vivida* nymphs is on Logie Creek at the place previously described. There on June 15, 1913, I took 42 nymphs varying in length from 3 mm. to 12 mm. Nine of these were in the mature stage. The other 31 on examination and measurement seemed to fall into two groups, which probably were a 1914 brood and a 1915 brood. As there were great differences among those of the youngest brood this may have represented two broods instead of one. I have not reared the female and have reared only two males.

3. NOTES ON ISCHNURA CERVULA AND ISCHNURA PERPARVA.

These notes were undertaken at the direct suggestion of Mr. E. B. Williamson, who thought that descriptions of the live colors of these species would be of value, especially in reference to any dimorphism in the coloration of the females.[1] In view of the present confusion among the described species and varieties of *Ischnura* from the Pacific slope, these notes have been made to include points other than color.

The two species are widely distributed over Washington and Oregon. Wherever I have found one of the species, the other, though perhaps not so abundant, has always been found. Both reach their greatest abundance around the alkaline ponds of the upper Sonoran Zone, but occur commonly and in some places abundantly in the Transition Zone. I have never found them in the Canadian Zone, but I have done very little collecting at that altitude. I have specimens of both species from the following localities: Oregon—Baker Valley, elevation 3,400 feet; Eagle Valley, 2,500 feet; Deschutes Valley (Bend, Oregon), 4,000 feet; Columbia River Gorge (Sherman, Oregon); Washington—Kittitas Valley, elevation 2,500 feet; Yakima Valley, 700 feet; Spokane Valley, 3,000 feet; Palouse Valley.

Both are all-season species, being on the wing from the first open spring weather until heavy frosts occur in the autumn. Both are seldom found far from the weedy banks of a pond or stream and both are found about either alkaline ponds or fresh running water. However, *cervula* seldom occurs abundantly except around alkaline ponds.

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[1] I wish to thank Mr. E. B. Williamson for his constant help and encouragement, as it is he who started me and has sustained my interest in this work.

ISCHNURA CERVULA Selys.

Figs. 77–80, 87–91, 94–100, 106–109, 117–121, 127–132.

While occuring from early spring till heavy frosts in the autumn, *Ischnura cervula* reaches its greatest abundance during the months of May and June. About running water it is scarce, in such places choosing the more stagnant spring laterals and side ponds. As with the other species of the genus, it is seldom found over the water or on land far from the moist banks of a pond or stream.

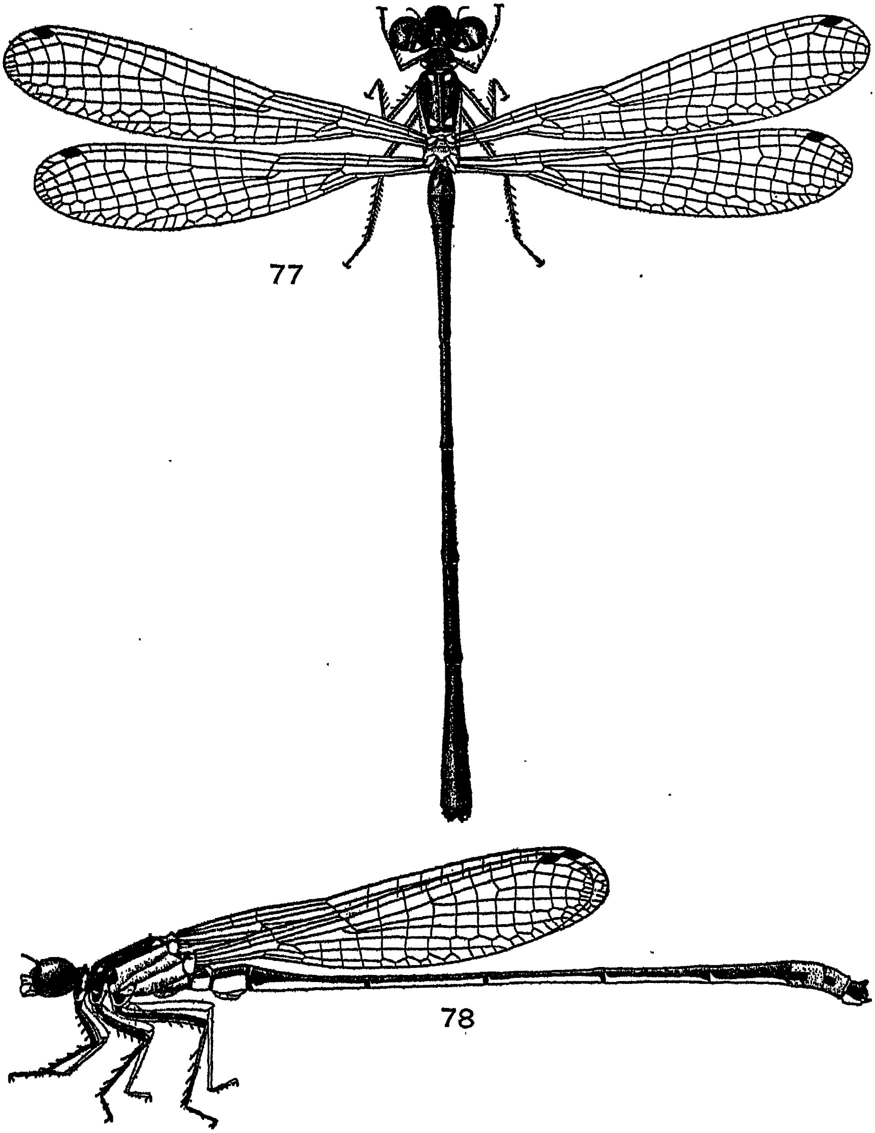
It emerges in the daytime, usually between 9 and 11 o'clock in the morning, when it can sometimes be found emerging in swarms. At such times the nymphs can be seen swarming to the bank with a tadpole-like wriggling motion. They usually wait about 15 minutes after crawling from the water until they dry and the back splits. A half hour later they are on the wing. This species has, especially during imaginal life, the *Lestes* habit of hanging among aquatic vegetation and dodging among the reed stems to avoid capture.

Copulation takes place with the couple moving about among the vegetation or at rest on some leaf, and lasts for many minutes.

In oviposition the female, usually unaccompanied by the male, deposits her eggs in any vegetable substance under the surface of the water which is soft enough to be pierced by her ovipositor, usually the stems of aquatic plants, but sometimes she will alight on the surface of a floating mass of filamentous algae and oviposit in the tangle of algal filaments. Usually the abdomen is bent U-shaped and the wings are loosely folded as in copulation, but occasionally she assumes the poses of *perparva*, with the wings tightly folded. (See figs. 87 and 88.)

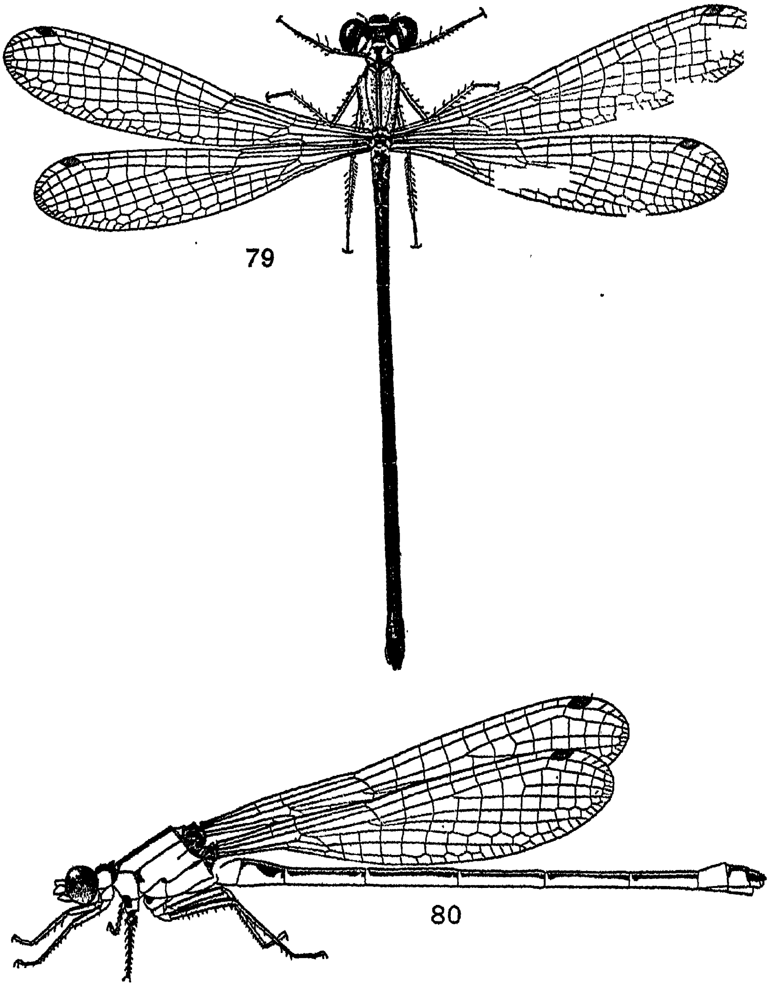
I have three pairs which were killed while in copulation. In one, the hold of the male on the prothorax of the female is still retained. Figure 89 shows how the parts fit together. The concave apical edges of the inferior appendages of the male rest on the anterior surface of the posterior lobe, each at about the base of the pencil of hairs. The inferior apical points of the superior appendages rest under the roof-shaped posterior lobe, while the angle of the superiors rests on the mesostigmal lamina. Probably in life the V-shaped prolongation of the dorsum of segment 10 rests on the mesothoracic carina of the female. In this dried pair it is slightly raised.

In copulation, segments 8 and 9 of the female are opposed to segment 2 of the male. The very heavy penis seems to be the sole clasping organ, as the "anterior hamules" fold inward during copulation (figs. 90 and 91), when the penis is exserted. Among my material I found a single male with the penis exserted and the "anterior hamules" and lamina folded in, but considered it deformed or injured until I examined the copulated pairs, when I recognized its true meaning. In none of the three dried pairs does the ovipositor sheath of the female fit into the depression of segment 2 of the male, which is made by the infolding of the anterior lamina and its attendant



Figs. 77–78.—Ischnura cervula, male. 77. Dorsal view. 78. Lateral view.

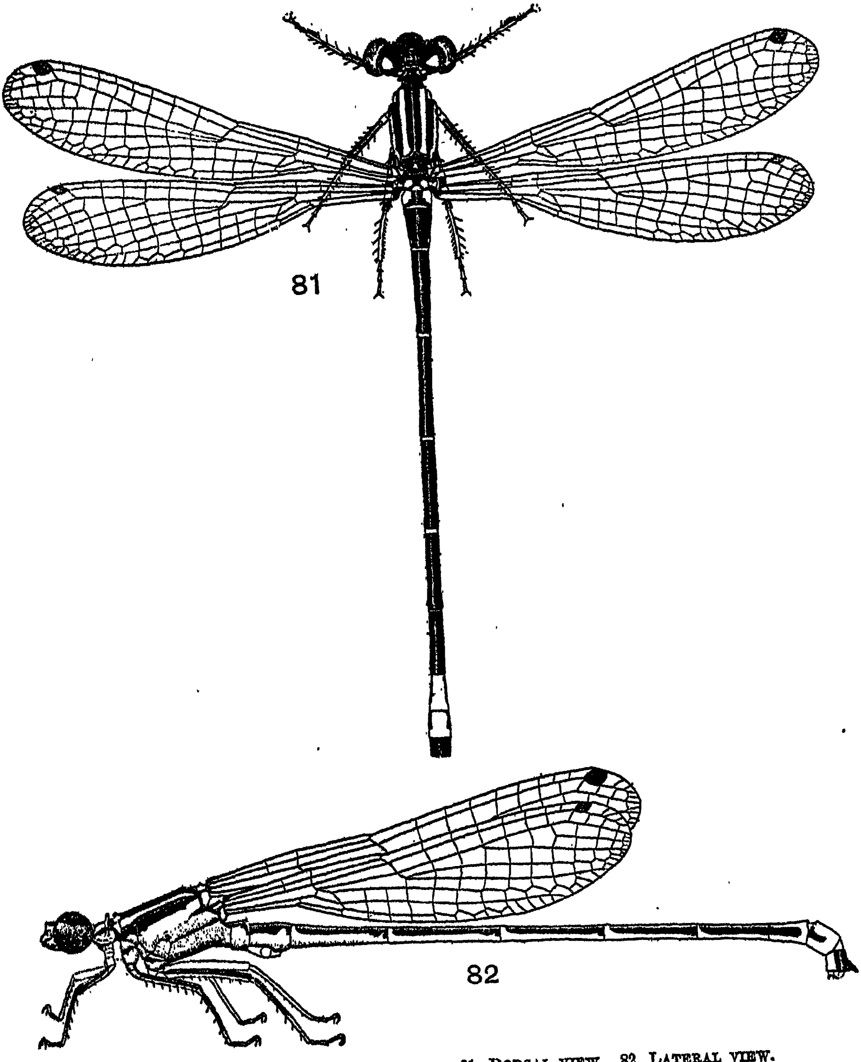
"anterior hamules." These "anterior hamules" then function not as claspers but as a sheath for the penis. The distal joint of the penis is bifurcate, the two rami being slender and twice as long as the undivided base of the joint. (Figs. 94 and 95.)



Figs. 79-80.—Ischnura cervula, female. 79. Dorsal view. 80. Lateral view.

Male (figs. 77, 78, 94–98, 109).—Labrum blue, with a horizontal black line above. Frons blue on the vertical surface, black on the horizontal surface. Vertex with blue band across front, small blue postocular spots, otherwise black, which is continuous with black of the upper part of the eyes. Antennae black. Upper fourth of eyes black, which is abruptly set off by a straight line from the pale bluish green of the middle eye, which shades gradually into lemon yellow below.

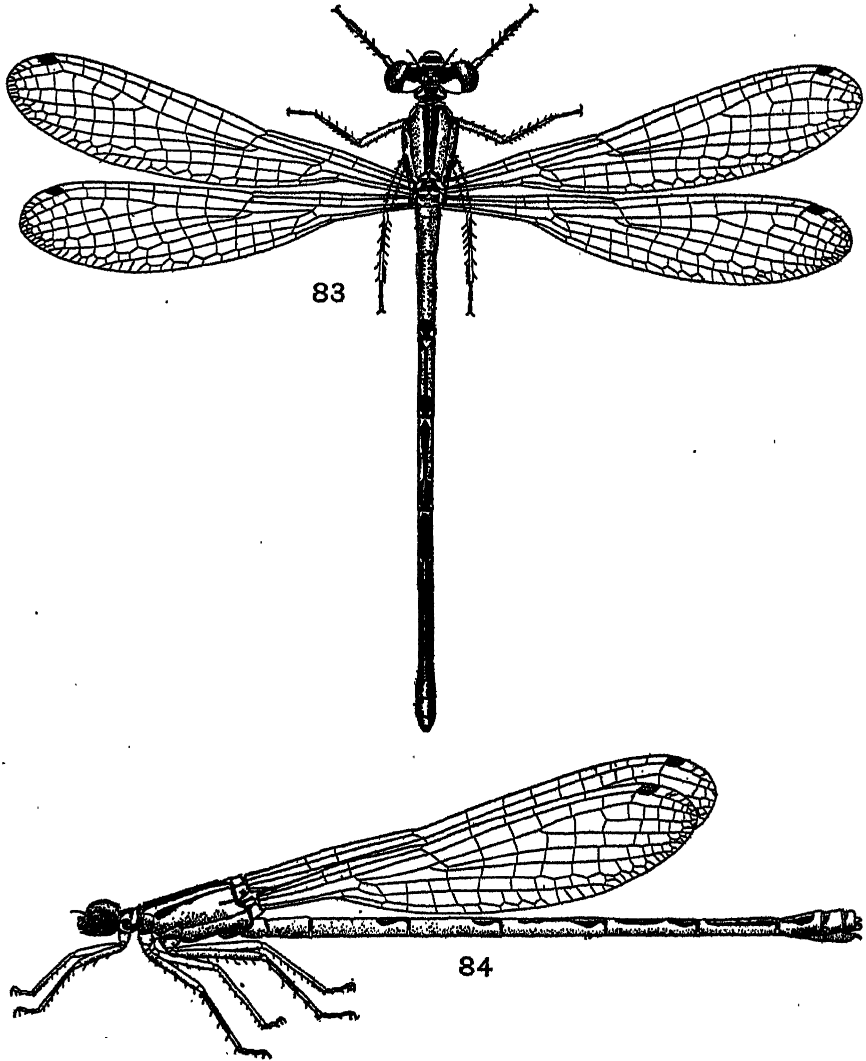
Prothorax black, except a narrow bluish vertical stripe on each side which runs down onto the greenish coxa. Legs black, except a narrow greenish stripe on inner surface.



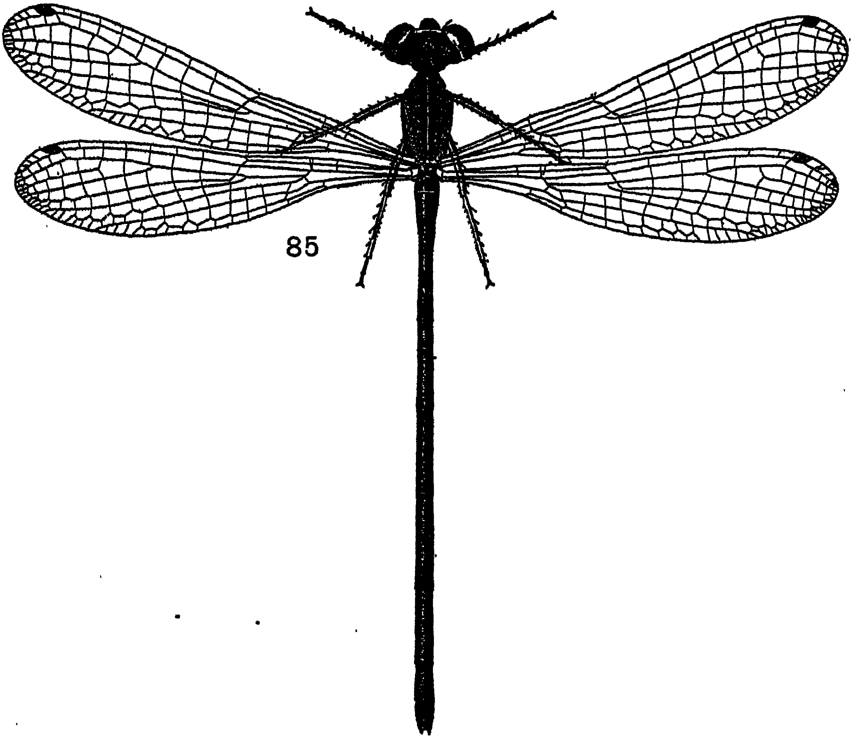
Figs. 81-82.—Ischnura perparva, male. 81. Dorsal view. 82. Lateral view.

Mesothorax and metathorax pale pure blue on sides, shading into greenish on the ventral surface. Mesepisterna and mesinfraepisterna black except an upper and lower blue spot on each mesepisternum. Second lateral suture black. Coxae with an outer anterior black spot. Legs colored as in first pair. Pterostigmas of equal size and black on both front and hind wings.

Abdominal segment 1 bluish green on sides, black on dorsal surface, except a semicircular pure blue spot on apical end of dorsum; segment 2 black above, bluish green below; segments 3–7 black above, yellow below, except an interrupted narrow basal band on segments 4–7; segments 8 and 9 pure blue, each with a rectangular black spot at the anterior end of each side; segment 10 black above, blue below.



Figs. 83–84.—Ischnura perparva, teneral female. 83. Dorsal view. 84. Lateral view.



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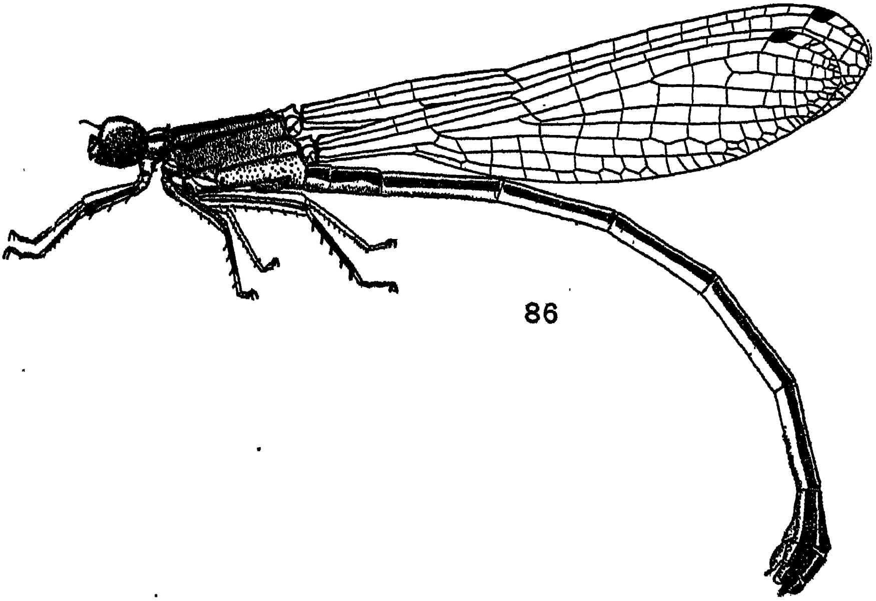

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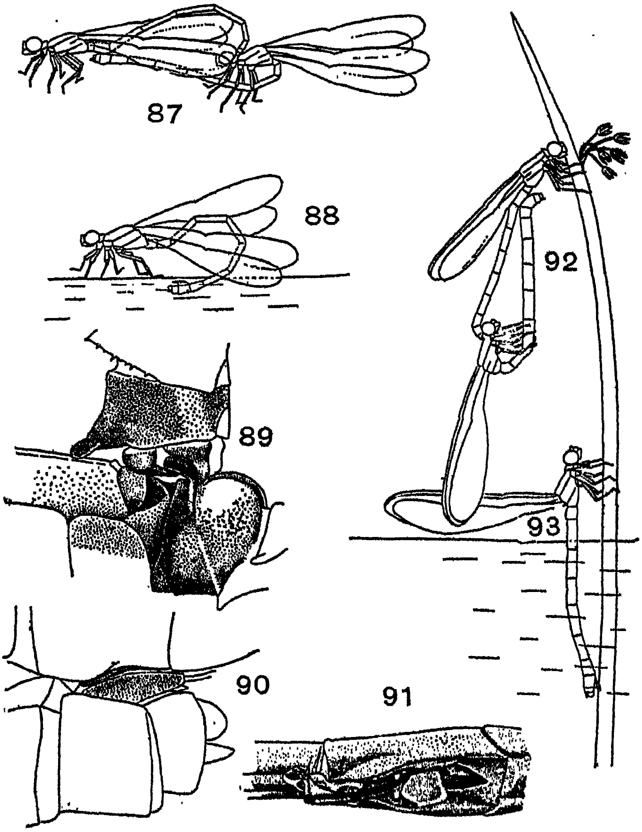
Figs. 85-86.—Ischnura perparva, aged female. 85, Dorsal view. 86, Lateral view.

In the teneral *cervula*, male, the general color immediately after emergence is pale gray with flesh tints. This is overlaid with the black color pattern. Within an hour or so segments 9 and 10 turn blue, the remaining general color being assumed more slowly. These changes are very simple compared with the series of changes through which the coloration of the *cervula* female goes.



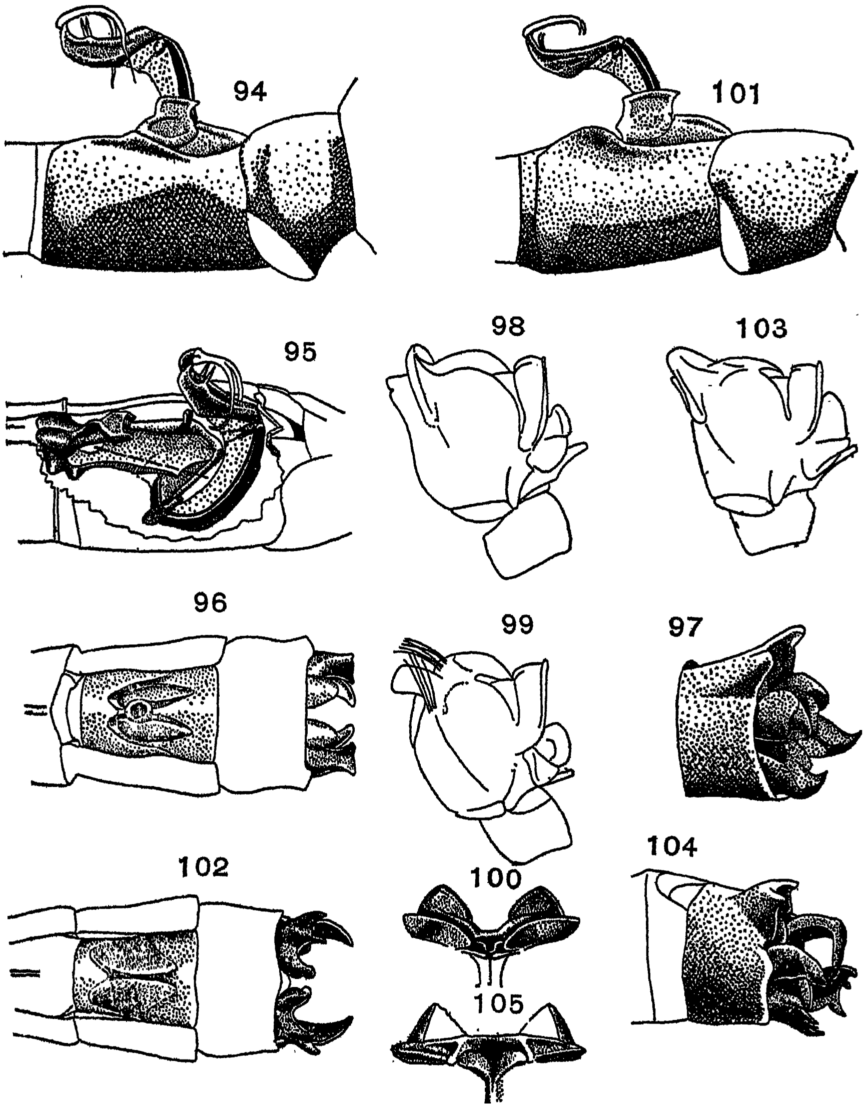
FIGS. 87–91.—ISCHNURA CERVULA. 87. IN COPULATION. 88. OVIPOSITING. 89. MALE CLASPING ORGANS ATTACHED TO FEMALE PROTHORAX. 90. COPULATION, DETAIL. 91. MALE, SEGMENT 2, PARTS IN COPULATORY POSITION.

FIGS. 92–93.—ISCHNURA PERPARVA. 92. IN COPULATION. 93. OVIPOSITING.

The following are the various colorations found among the females (figs. 79, 80, 106–108, 117–119):

1. *Female.*—Teneral colors mostly a light shade of brown with black markings. (See figs. 106 and 117.)

Labrum gray, shading into brown above, edged above by a horizontal black line. Frons gray on vertical surface, black on horizontal surface. Vertex black, but with a broad transverse band of gray in front connecting the gray genae. Postocular spots large, brown, and connected by a brown line. Antennae black. Eyes light gray, with darker spots. Under surfaces of head pale gray, almost white.

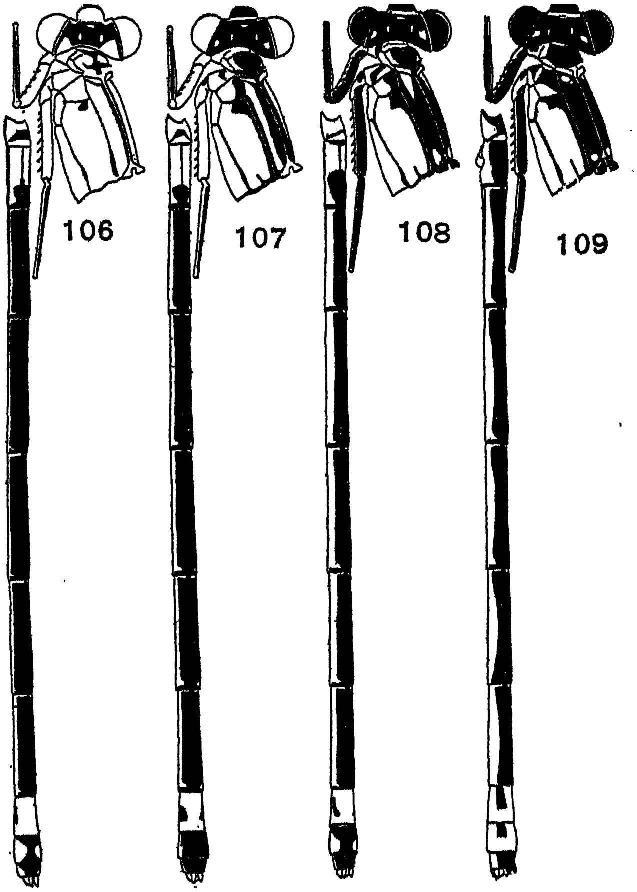


FIGS. 94–100.—ISCHNURA CERVULA. 94. MALE, SEGMENT 2. 95. MALE, SEGMENT 2 DISSECTED. 96. MALE, SEGMENTS 9 AND 10, VENTRAL VIEW. 97. MALE APPENDAGES. 98. MALE PROTHORAX. 99. FEMALE PROTHORAX. 100. FEMALE MESOSTIGMAL LAMINA.

FIGS. 101–105.—ISCHNURA PERPARVA. 101. MALE, SEGMENT 2. 102. MALE, SEGMENTS 9 AND 10, VENTRAL VIEW. 103. MALE PROTHORAX. 104. MALE APPENDAGES. 105. FEMALE MESOSTIGMAL LAMINA.

Prothorax brown, marked with black as follows: A narrow transverse line at base of anterior lobe. This widens on the middorsal line into a triangle, the apex of which extends caudad to the anterior angle of a diamond marking at the base of the posterior lobe. Legs pale brown except narrow black stripe on outer surface of tibiae.

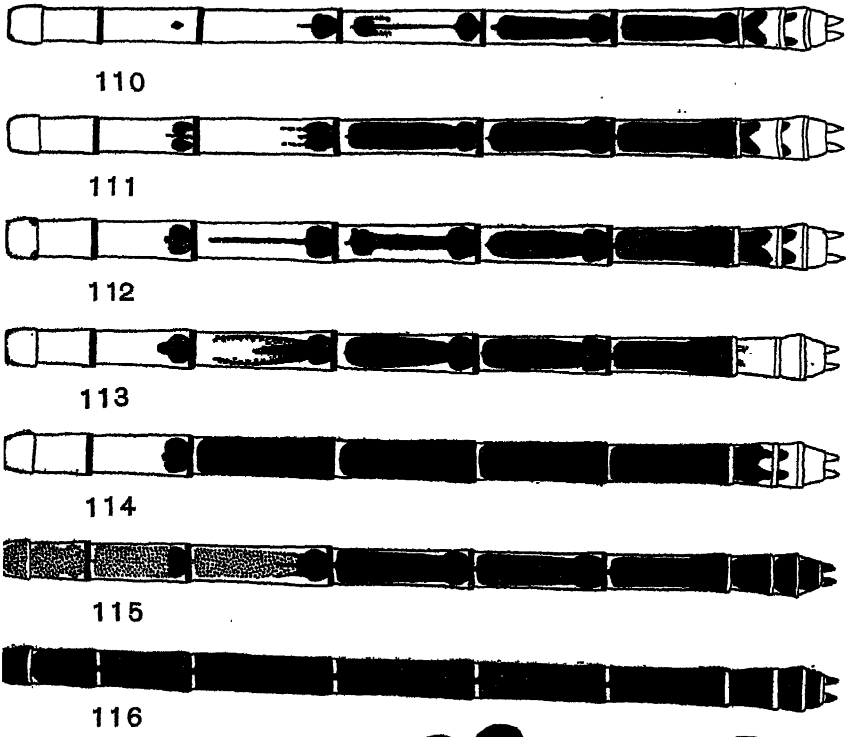
Mesothorax and metathorax pale brown, except as follows: Broad middorsal stripe (in some individuals a mere line); a spot on the anterior end of mesepimeron; dorsal end of both humeral and second lateral sutures narrowly black. Legs as in prothorax.



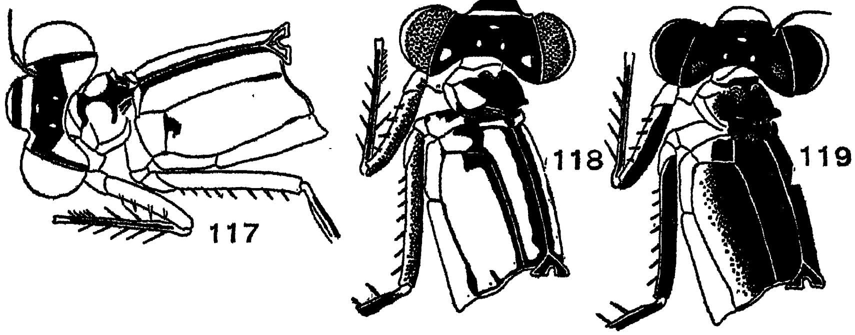
Figs. 106-109.—Ischnura cervula. 106. Teneral female with light coloration. 107. Teneral female with dark coloration. 108. Female with very dark coloration which approaches male coloration. 109. Male coloration.

Abdomen pale brown, except as follows: Segment 2 with a diamond-shaped, or in some individuals a spade-shaped spot on posterior end of dorsal surface; segments 3 to 7 each with dorsal surface black, except for a narrow pale interrupted band across the anterior end; segment 8 pale blue, usually with small lateral mark; segments 9 and 10 with dorsal surface black, the black extending down in a narrow stripe on either side of the anterior end.

2. *Female.*—Some teneral females (figs. 107 and 118) are more heavily marked than the previous description would indicate, but the form intergrades with the first. In this form the postocular spots are very much reduced and have no connecting bar. The entire dorsal surface of the prothorax is black. The coxae have an anterior black spot.

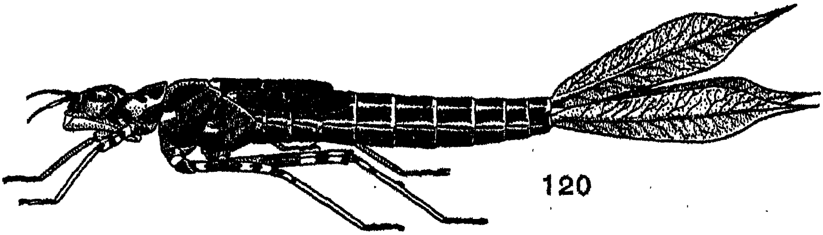


FIGS. 110-116.—ISCHNURA PERPARVA, FEMALE. 110-114. VARIATIONS IN TENERAL COLORATION. 115. STAGE INTERMEDIATE BETWEEN TENERAL AND ADULT, SHOWING FORMATION OF ADULT COLORATION ON SEGMENTS 1-4. 116. ADULT COLORATION.



FIGS. 117-119.—ISCHNURA CERVULA, FEMALE. 117. TENERAL FEMALE WITH LIGHT COLORATION, SAME AS FIG. 106. 118. TENERAL FEMALE WITH DARK COLORATION SHOWING FORMATION OF ADULT COLORATION ON EYES AND FEMORA, SAME AS FIG. 107 BUT OLDER. 119. FEMALE, FINAL OR SENILE COLORATION.

Upper half of mesinfraepisternum black. Middorsal stripe broad. Humeral stripe broad and widening below into a large rectangular spot on anterior end of mesepimeron. Second lateral suture with a narrow black line. Femora brown as in the lighter individuals.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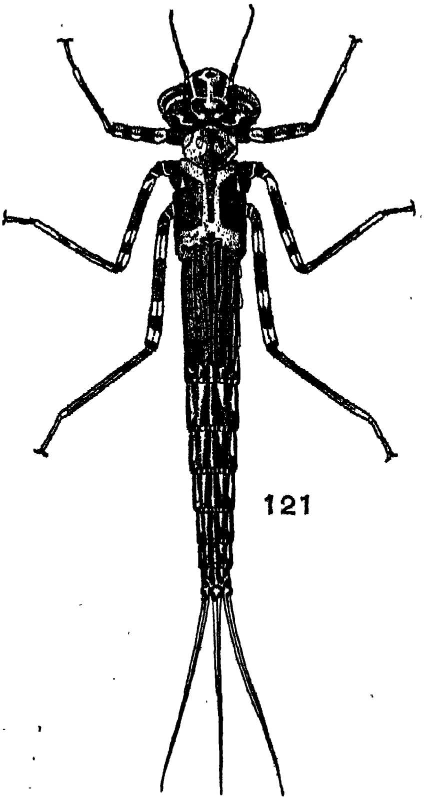
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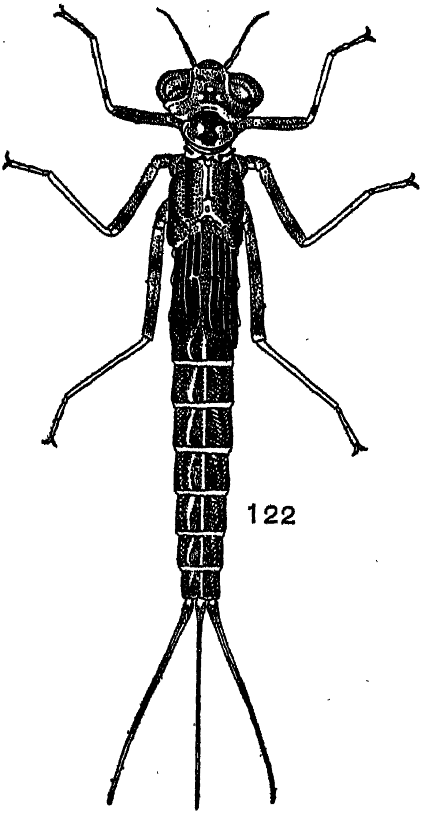
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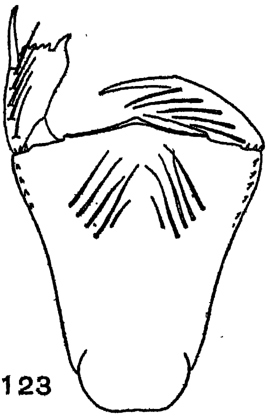
FIGS. 120-121.—ISCHNURA CERVULA, NYMPH.
FIG. 122.—ISCHNURA PERPARVA, NYMPH.

Abdomen same as in the lighter colored females except that the dorsum of segments 9 and 10 may be black. (Fig. 107.) Figure 118 shows one of these females in a late teneral stage, when eyes and femora are turning black.

3. *Female.*—Adult coloration: Labrum greenish, frons blue on vertical surface, black on horizontal surface. Vertex black, including upper one-fourth of eyes, which is sharply demarked from the lower greenish three-fourths by a horizontal line, except a pale pure blue band across front of vertex from eye to eye and the usually connected pale blue postocular spots.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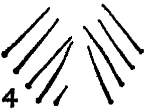
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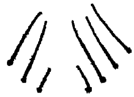
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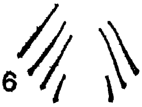
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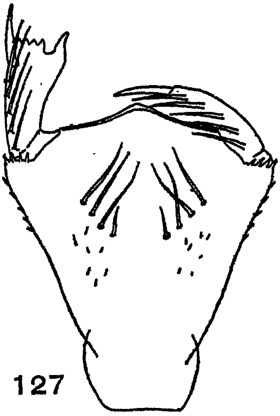
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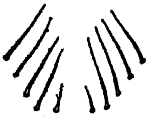
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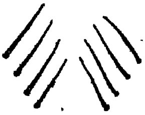
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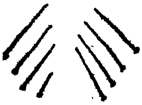
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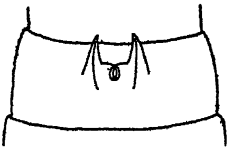
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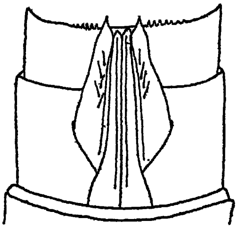
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FIGS. 123-126.—ISCHNURA PERPARVA, NYMPH. 123. DORSAL VIEW OF LABIUM. 124-126. MENTAL SETA OF THREE REARED NYMPHS.

FIGS. 127-132.—ISCHNURA CERVULA, NYMPH. 127. DORSAL VIEW OF LABIUM. 128-130. MENTAL SETA OF THREE REARED NYMPHS. 131. MALE SEGMENT 9, VENTRAL VIEW. 132. FEMALE SEGMENT 9, VENTRAL VIEW.

Thorax pale blue, but markings may be either as in description No. 1 or No. 2. Coxae and femora vivid rose pink. Femora and tibiae with an outside black stripe. Pterostigmas pale brown.

Abdomen marked as in tenerals, but segments 1 and 2 blue, segments 3 to 8 greenish yellow, and segments 9 and 10 pure blue.

4. *Female.*—Final or senile coloration (fig. 119): Labrum olive. Vertical surface of frons olive, horizontal surface black. Entire dorsal surface of head black, including the sharply defined dorsal one-fourth of the eyes. Lower three-fourths of eyes green, shading into yellow below.

Prothorax black on dorsal surface, shading into olive on sides and coxae. Legs black, with bluish olive stripe on lower surface.

Mesothorax and metathorax black on dorsal surfaces, shading into olive on lower sides. Legs as in first pair.

Abdomen with dorsal surface black, shading below into olive on segments 1 and 2, into yellow on segments 3 to 7, and into olive on segments 8 to 10.

5. *Female.*—Melanistic. I have a single melanistic female (fig. 108), which approaches the male coloration.[1]

Labrum gray, with black line above. Frons blue on vertical and black on horizontal surface. Vertex black, except small round disconnected postocular spots and the blue stripe from eye to eye along its anterior edge. Eyes black on upper one-fourth, green below.

Prothorax with black band across anterior lobe. Middle lobe black on dorsal surface. Posterior lobe black, except a large blue triangle on each outer angle. Coxae blue, with black anterior spot. Legs black, with bluish stripe on inner surface.

Mesothorax and metathorax with sides and lower surface blue, with very broad middorsal and humeral stripes which fuse along the middle two-fourths of their length, leaving a pair of oval blue spots near the antealar sinus, and below, a pair of lanceolate blue spots next the mesostigmal laminae. Legs as in the prothoracic legs.

The abdomen has the distinctive female coloration described in No. 1.

The "adult coloration," No. 3 of *cervula* females, is a stage which is rather transitory, as the delicate blues, pink, and yellow become early obscured by black, which in the very old females may become slightly pruinose. The females, which I reared, emerged into coloration No. 1 or No. 2, and died while still in that color, but in the field I have taken very fresh appearing females of coloration No. 3. Because of the difficulty always found in arranging a large series of fresh females in a series according to the age of their coloration, I have wondered if coloration No. 3 could also be a teneral and representing a second form of coloration. All the aged females are black, No. 4. As this species frequently emerges in swarms the tenerals are at times very numerous. However, the coloration which is ordinarily found is black (No. 4). At any time in May or June, when this species is most abundant, individuals in every stage of coloration can be taken.

Within a few hours after death the delicate pink, blue, and yellow fade, leaving the dried specimens gray or pale brownish.

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[1] Since writing this I collected a second female of this coloration in the Sacramento Valley of California and several others at Palo Alto. In these the 4 thoracic blue spots are similar to those of the male.

As in females of *perparva*, the late or adult black pattern is superimposed on the black pattern of the teneral and is not a development from the first black pattern. This is especially noticeable in the thorax, where the dorsal and humeral stripes remain sharply defined, though only faintly visible until the intervening blue mesepisternal stripes become almost black.

The nymphs of both *cervula* and *perparva* are to be found in large numbers in the trash among cattails in the "tule" swamps south of Sunnyside. While a rake brings out both species, the nymphs of *perparva* are usually covered with mud, while *cervula* nymphs are clean, though one species is about as hairy as the other. This fact, in connection with that of the shorter legs of the *perparva* nymphs, suggests that the *perparva* nymphs are more mud-loving and that the *cervula* nymphs prefer the trash and aquatic vegetation above the slimy bottom.

The descriptions of the nymphs of *cervula* and *perparva* are based on 10 *cervula* and 12 *perparva* nymphs which were reared at Sunnyside during June and July, 1913. It is easy to notice certain differences in color and length of legs between the two series of exuviae, when laid in two rows for comparison, but the differences are so slight and so easily confused by other varying conditions that I can not certainly separate from a mixed series any but the most brightly colored *cervula* larvae. *Perparva* nymphs may be pale brown, black, or bright green, probably depending on food and nearness to molt. Usually *cervula* nymphs are easily distinguished by their brilliant black color pattern, especially the vivid banding on the legs. In some reared specimens, however, the exuviae are almost without color, although even in these the bands of the legs, though pale, are sharply defined.

Nymph (figs. 120, 121, 127–132).—Length, 11–12 mm., gills, 6 extra; abdomen, 8; hind femur, 3.

Color usually black because of the heavy color pattern, though it may be very light. Among the exuviae are 7 males, which vary from almost colorless to very black.

Head with the distance between antennae relatively wide, in measured specimens being five-sixteenths of width of head. This extra width is correlated with a greater width of the anterior edge of the submentum than is found in *perparva*. The mentum is usually slightly shorter than in *perparva*, thus accentuating the slightly greater width. However, perhaps from warping, the mental proportions in exuviae are not constant. Mental setae usually four in each row—in one specimen five in each row. Each lateral lobe with five raptorial setae, a large movable hook, and five end teeth the inner one of which is large and set off from the row of four small ones by a deep notch.

Thorax relatively large; wing pads held parallel and reaching to the middle of the fourth abdominal segment. Legs long and sprawling. Abdomen conical, slender; the gills large, increasing in width to the apical third, then rapidly reduced to an attenuate apex.

The color pattern is complex, usually vivid, and is as follows: Head black, with white area over location of adult median ocellus, from which a stripe runs forward and a branch on either side runs laterad of its eye and antenna. Postocular spots comma-shaped. Eyes gray. Prothorax white, with a black *fleur-de-lis* design. Coxae and trochanters black, femora with two black bands and the distal end black. Mesothorax and metathorax black, with middorsal pale areas and the dorsal edges of the episterna light. A light spot on the dorsal half of each infraepisternum. Legs banded as in the first pair. Abdomen black, with a row of spots along the lateral keels, a middorsal stripe, and a row of spots on each side midway between the lateral keels and the middorsal stripe. Gills plain.

This nymph differs from that of *perparva* in the longer legs, the greater distance between the eyes, and the sharp banding of the legs.

ISCHNURA PERPARVA Selys.

Figs. 81–86, 92, 93, 101–105, 110–116, 122–126.

Ishnura perparva occurs during the entire odonate season and is frequently as abundant along the stagnant side pools of fresh streams as it ever is about alkaline ponds, where it occurs in equal abundance with *cervula*. In other words, it seems to be adapted to a wider variety of conditions than *cervula*.

In habits it resembles *cervula* but, when at rest in copulation (fig. 92), or ovipositing (fig. 93), the wings are usually held tightly closed. Being a heavier bodied insect, the abdomen is seldom bent into the U-shapes common with ovipositing *cervula*. As in *cervula* the males rarely accompany the females while the latter are ovipositing.

Male (figs. 81, 82, 101–104).—Labrum greenish, with black line above. Frons greenish in front, black on horizontal surface. Entire top of head black, except broad greenish band across front and small greenish postocular spots. Antennae black. Eyes abruptly black above, pale green below.

Prothorax black above, except narrow greenish line along base of anterior lobe and a small greenish spot on either side of the middle lobe. Sides of prothorax, coxae, and legs yellowish green, with femora broadly black on outer surface and a narrow stripe on outer face of tibiae.

Mesothorax and metathorax pale green, with broad middorsal stripe and broad humeral stripes. Legs colored as in first pair.

Pterostigma of fore wings black, of hind wings dusky, those of hind wings much smaller.

Abdominal segment 1 pale green, with triangular black spot and a black apical line extending down either side; segment 2 greenish with dorsum broadly black and a black apical line as in segment 1; segments 3–7 black above, lemon yellow on sides and ventral surface; segments 8 and 9 pale blue, with a rectangular black spot on either side; segment 10 with dorsal half black and ventral half yellow.

In the teneral male the colors on emergence are steel gray with the above described markings.

Female (figs. 83–86, 105, 110–116).—The females of *perparva* do not possess two color forms in the mature imago. The mature colors are an obscure smoky green with black markings, which is usually very heavily overlaid with a gray pruinose.

The teneral colors (figs. 83, 84, 110–114) are orange and black, and in detail are as follows:

Labrum pale greenish orange, with a minute black triangle on its dorsal edge. Frons orange on its vertical surface and black on the horizontal surface. Vertex orange between the antennae, the remainder black, except large connected orange postocular spots. Eyes dark green above, pale below. Antennae black. Under parts of head pale yellowish.

Prothorax orange, paler on lateral and ventral surfaces. Anterior lobe with anterior edge black; middle lobe black, with a small orange area on each side; posterior lobe orange. Coxae, trochanters, and femora pale orange and without markings. Tibiae yellow, with a narrow black stripe on outer side. Tarsi green.

Mesothorax and metathorax orange, paler below, with a broad black dorsal stripe. On either side a black humeral stripe, narrower across the dorsal edge of the mesinfraepisternum. Legs colored as are first pair. Wings colorless, pterostigmas clear, yellowish.

Abdomen orange, marked with black as follows: Segment 1 with two minute spots on dorsal surface; segment 2 with minute cross line on dorsal surface and a narrow apical ring; segment 3 with a spade-shaped marking on apical one-fourth of dorsal surface, and an apical ring; segments 4 to 7 with dorsal surface black, except narrow basal ring, and on segment 7 a narrow apical ring; segment 8 with a large U spot, the U opening caudad; segment 9 with small anterior spot on either side; segment 10 orange.

The teneral on emerging is a pale flesh color with the dark markings just described indicated by gray. Within an hour or two the orange and black coloration has been assumed. Figure 114 shows the usual color pattern on the abdomen of a teneral female *perparva*. Figures 110 to 113 are less common forms. Figure 115 shows a female colored as in figure 111, which is passing from the teneral color pattern to the adult pattern shown in figure 116, by the darkening of the orange areas shown in the figure by stippling. As mentioned for *cervula* females, the adult black pattern is superimposed onto the teneral black pattern by certain of the orange areas becoming brownish, then smoky, and finally black.

The following black markings appear on the mature female (see figs. 85, 86, 116):

All of the dorsal surface of head black, except pale band above frons. Entire dorsum of prothorax black. Dorsum of all abdominal segments black, except a narrow pale apical cross line on segments 1, 7, 8, and 9. Pterostigmas smoky. The entire body and legs are more or less pruinose, making a slate gray insect. The paler colors of the sides of the thorax and legs and sides of the abdomen, which are obscured by this pruinosity, are olive green. In very old females the only light color remaining is a brownish stripe on the outer edge of the mesepisternum. In dried material the blue element in the olive green fades, leaving the insect brownish or orange with pruinose and black markings. In both species the blue element, either pure and by itself or in a mixed color like green, is very likely to fade easily in dried material, leaving the more permanent yellow element. This is probably where the frequent dimorphism of the female Ischnuras comes in. The males are seldom pure blue, but greenish—a combination with a yellow and a blue element. In the yellow dimorphs the blue element is lacking. However, in *perparva* the orange female is merely the teneral.

The mature pruinose females of this species are very common, the males less common, the orange teneral less common yet, and the intermediate forms between the orange teneral and the adult pruinose female are rare. Among 250 specimens I have 40 orange tenerals and only 5 intermediate between the teneral and the pruinose. I have inferred that the orange teneral condition lasts the first day, the change to adult occurring during the first night of imaginal life. But this is merely a guess to account for the rarity of the intermediate forms.[1]

Nymph (figs. 122–126).—The nymph of *perparva* has been described by Needham. The following points may serve to separate it from that of *cervula* and other species: Length, 11–11.5 mm., gills, 5 extra; abdomen, 7–7.5; hind femur, 2.5; width between eyes four-sixteenths of total width of head. This nymph is similar to that of *cervula* but differs in the shorter legs, the narrower space between the eyes, and the obscure color patterm. In life, because of the muscles and other internal organs showing through, the *perparva* nymphs are easily confused with the more lightly pigmented *cervula* nymphs. However, in the exuviae, while the legs frequently show indistinct bands, the edges of these fade out, giving a lack of sharp definition as occurs in *cervula*, even in the pale *cervula* exuviae. As shown by the figures 124–126, the labial setae are not a reliable diagnostic character.

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[1] I have just succeeded in rearing and keeping a teneral female alive four days without change of the orange color. The change in color may be due to fertilization.

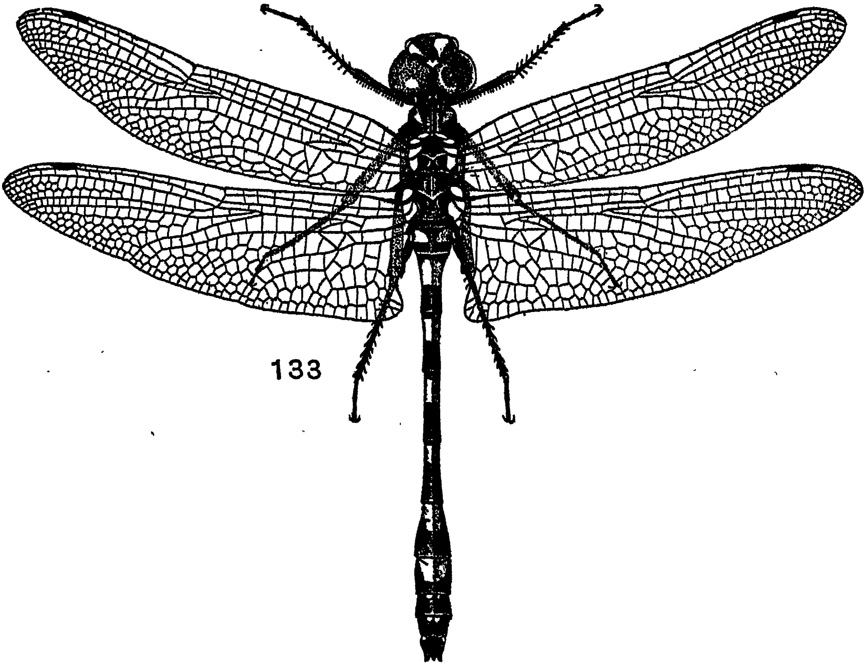
4. NOTES ON MACROMIA MAGNIFICA AND ITS NYMPH.

While collecting on Satus Creek, Yakima County, Washington, July 27, 1913, I became suspicious of my determination of certain very swift dragonflies which I had been unable to net, but which I had hitherto thought were *Aeshna multicolor*. To satisfy myself I returned August 3 with a shotgun, a few shots from which showed these swift fliers to be Macromias, which on later examination proved to be *Macromia magnifica* (figs. 133–145). After using 25 shells loaded with No. 10 shot I hit nine Macromias, five of which were still usable as specimens.

On August 7 I returned with Professor Farr, of Sunnyside, and during two days of strenuous effort we netted three Macromias. With the use of the gun and a second box of shells we procured three more specimens. On this trip we searched for nymphs and exuviae, but found none.

On August 24 I returned alone and netted a single specimen, the same day finding five exuviae in an alder tree. These were from 2 to 10 feet above the surface of the creek in a tree, under whose roots the creek had cut, forming a pool about 3 feet deep, which was half filled with the fibrous alder roots. One exuvia was fastened with outspread legs close to the trunk of the tree, but the other four nymphs had crawled up and out on limbs and finally onto twigs less than the size of a straw, from which the skins were hanging back downward. As these were found late in the day I did not search further, but returned on September 7. This time in an alder tree similarly situated were found six more exuviae, while in the mass of roots in the pool beneath the tree was found a live nymph of the 1914 brood. A short distance from this in a third alder tree overhanging an undercut bank were found three more exuviae. Probably Macromias had emerged from other tree-fringed pools but these three trees were the only ones so situated that they were well enough protected from the wind to prevent the blowing down of the exuviae, as these must have been hanging, when found, not less than six weeks.

As contrasted with the restless activity of the adults the movements of the nymph were extremely deliberate. In fact, he betrayed his presence in the tree roots thrown out onto the bank, not by his movements but by a slight chirping noise made in expelling air from the cloacal chamber.



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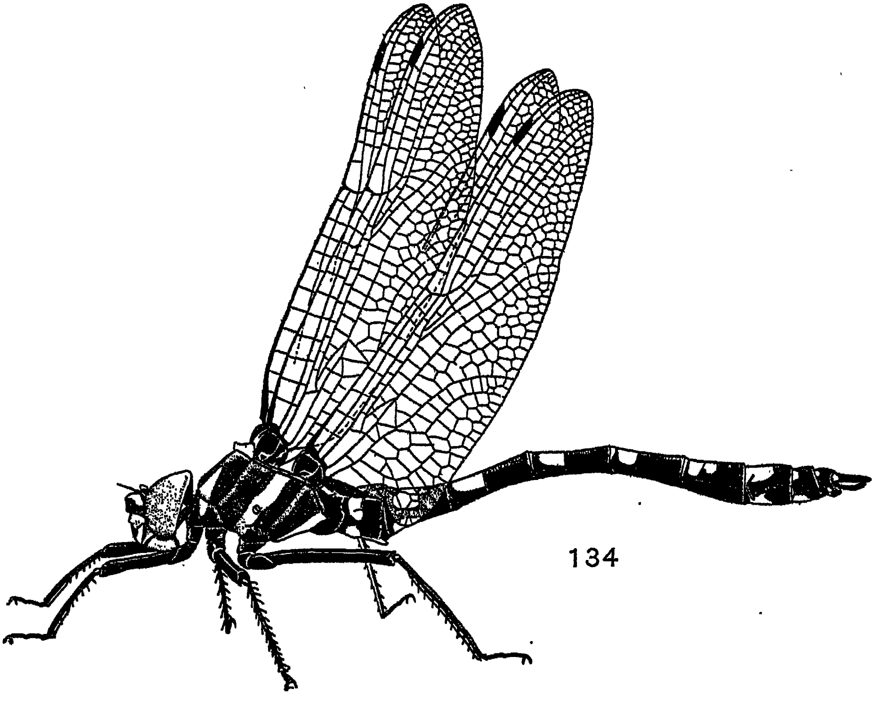

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FIGS. 133-134.—MACROMIA MAGNIFICA, MALE. 133. DORSAL VIEW. 134. LATERAL VIEW.

As the numbers of these Macromias were at their height on July 27 they probably had been on the wing three weeks, for they rapidly disappeared after August 7, and none were seen after August 24.

A short description of the Satus Creek region is given in my second paper of this series (see pp. 269–270), but the following details may serve to make more clear the habits of this species. Satus Creek, after it emerges from Satus Canyon onto the Yakima River flats, is a cool shallow stream of less than 10 second-feet, which meanders over long gravel riffles from pool to pool. These pools are about 25 feet wide, from 50 to 200 feet long, and, with few exceptions, are not over 4 feet deep. They are gravel bottomed, except under high dirt banks, where there is usually some mud, and are free from aquatic vegetation and brush, thus offering no protection to dragonfly nymphs, except pools overhung by alders, where the alder roots form intricate masses inhabited by lamprey eels, crayfish, and the nymphs of *Agrion aequabile yakima, Aeshna umbrosa occidentalis,* and *Macromia.*

The male Macromias were usually found patrolling the larger pools or sometimes a patrol would include two or three of the shorter pools. Seldom were more than three or four males seen at any one time, and each male's beat was rarely over 300 feet long. The flight was very swift, ordinarily about 2 feet above the surface of the water and straight down the middle of the pools or, on the broader pools, up one side and down the other. For speed few dragonflies can equal it. The speed was so great that even when I knew the passing dragonfly was a Macromia, black with yellow spots, it appeared a uniform gray; hence their confusion on the wing with Aeshnas. They were unusually fearless and in the futile attempts to take them many times dodged between the collector and the net. One even flew between my legs. After much aggravation I found that by wading into the deeper parts of a pool and facing a dirt bank not less than 5 feet high so as to leave a passageway of about 4 feet for the patrolling Macromias, occasionally one could be netted, for the nearness of the overhanging bank seemed to make them fear to dodge. They were perhaps a little more easily taken when struck at from the rear than when coming head on into the net, for when coming head on and fairly in the net, before the collector could twist it shut they would bounce back and out, apparently rebounding by some trick of the wing on the cushion of dead air in the net.[1]

This species was found most commonly over the water on calm days between the morning hours of 7 and 10. Few were found in the afternoons or on windy days. The flight over the water appeared to be controlled by the ovipositing females, who resorted to the water to oviposit early in the day in calm weather, where they were sought

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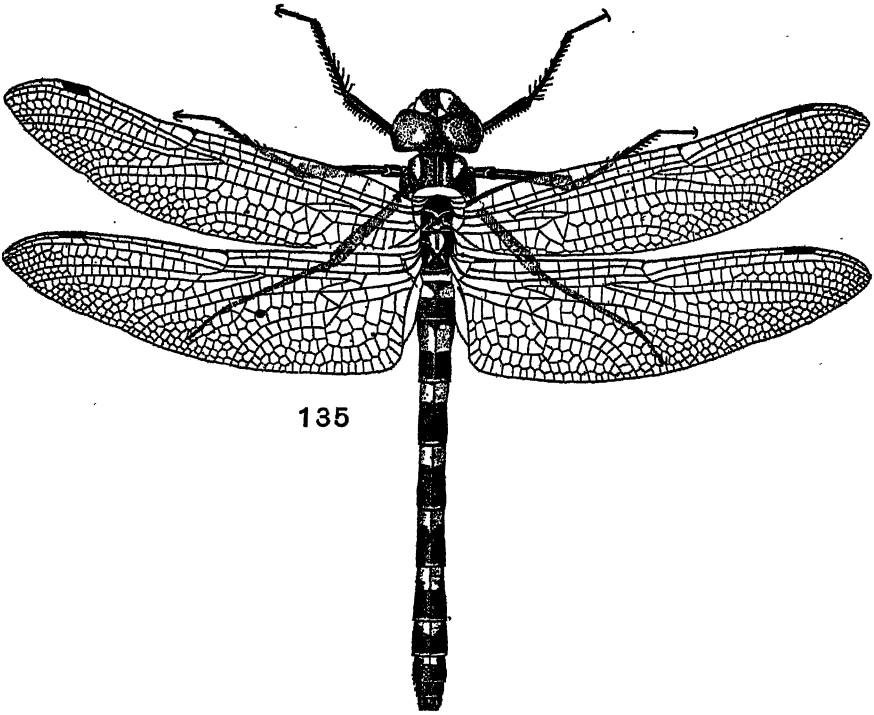
[1] I have since found this species common on the larger warmer streams of California and Nevada and in some places rather easily captured.



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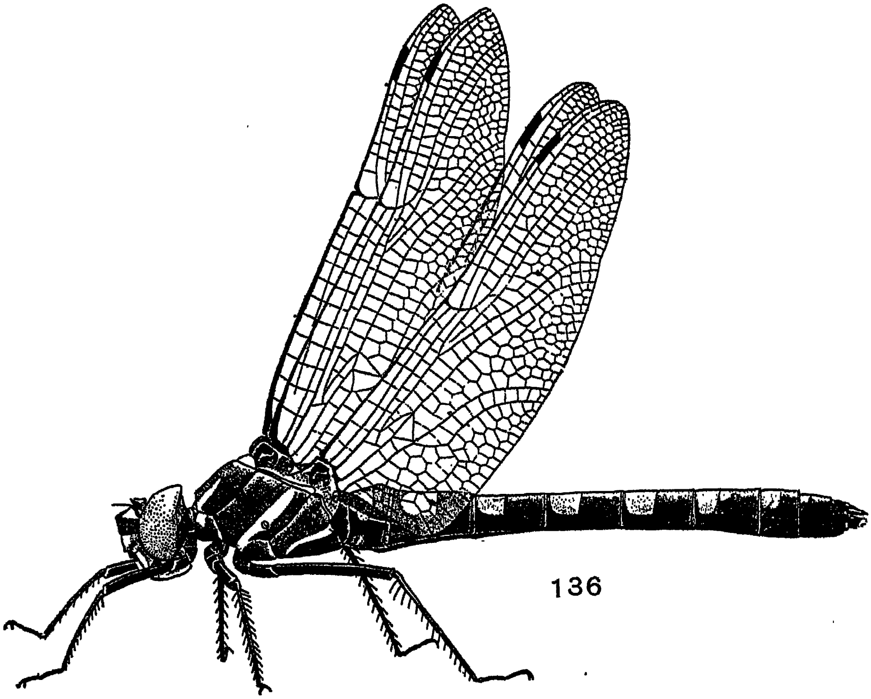

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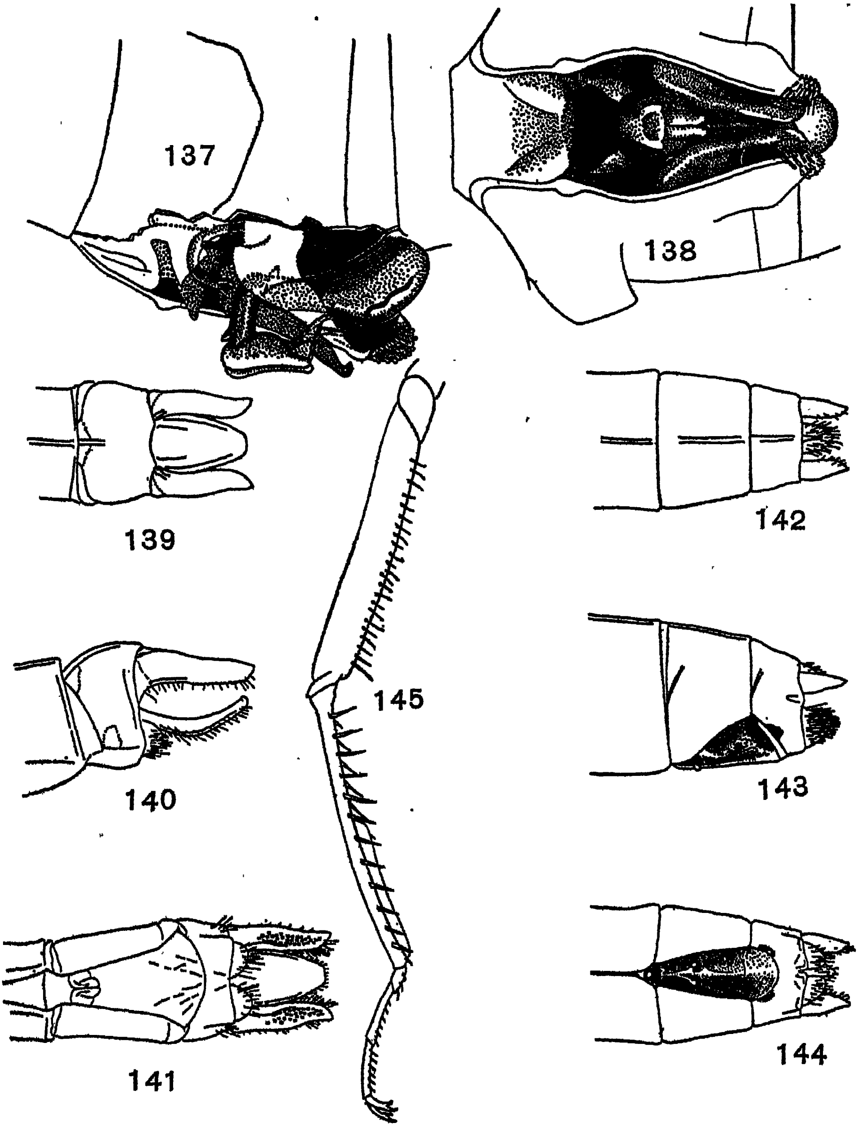
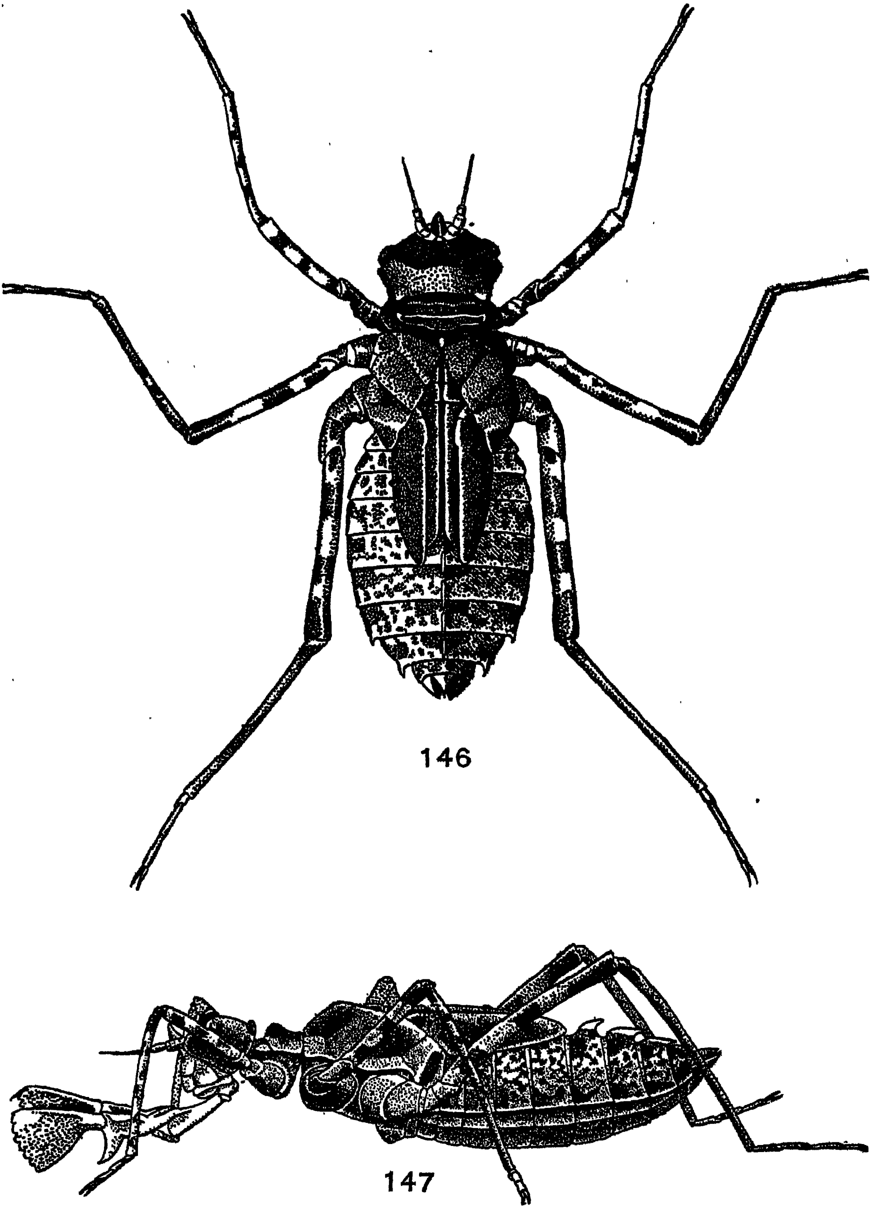
FIGS. 135-136.—MACROMIA MAGNIFICA, FEMALE. 135. DORSAL VIEW. 136. LATERAL VIEW.



FIGS. 137-145.—MACROMIA MAGNIFICA. 137-138. SEGMENT 2 OF MALE. 139-141. SEGMENT 10 AND APPENDAGES OF MALE. 142-144. SEGMENTS 9 AND 10 OF FEMALE. 145. FRONT LEG OF MALE SHOWING TIBIAL KEEL.

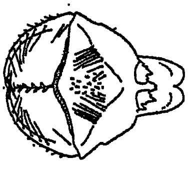
by the males. As the females oviposited by striking the end of the abdomen on the surface of the largest pools only, this could not be done except when the surface was smooth. At other times even until late twilight individuals of both sexes might be found patrolling glades and barnyards as much as a half mile from water. Here the flight varied from close over the ground to as high as the trees. One pair was seen in copulation at noon a half mile from the creek.



FIGS. 146–147.—MACROMIA MAGNIFICA, NYMPH. 146. DORSAL VIEW. 147. LATERAL VIEW WITH LABIUM EXTENDED.

On only two of the days spent in collecting was the weather calm enough to permit free oviposition. On these days there were three or four males to each female. In ovipositing the female would fly several times back and forth over a short beat of 40 or 50 feet, striking her abdomen on the surface of the water at 3 to 5 foot intervals. This beating back and forth generally lasted until a male discovered her, when she would be taken away in copulation. At such times the male swooped and grasped the female's head with his feet, then bending the abdomen forward and grasping the female's head with the abdominal appendages he would free his feet and she would bend her abdomen forward and copulate. (See fig. 159.) The copulatory flight was ordinarily away from water over the surrounding trees, but ended in a long period of copulation while resting on some bush or tree. One pair, observed resting in copulation for 15 minutes, on being disturbed flew away still in copulation.

In form and coloration the specimens collected on Satus Creek (see figs. 133–136) agree with the description in Mr. Williamson's review of the genus, except that the length of the abdomen in the males varies from 51 to 53 millimeters. In life the eyes are pale gray, the thorax a deep brown overlaid with pruinose.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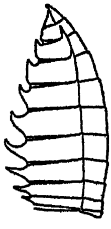
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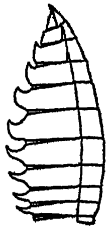
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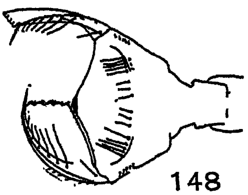
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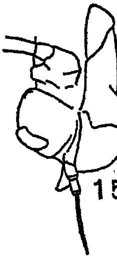
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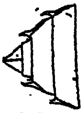
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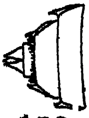
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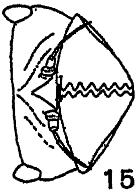
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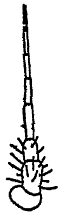
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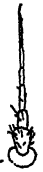
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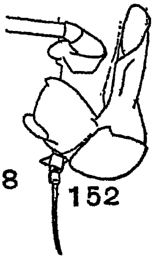
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FIGS. 148-153.—MACROMIA MAGNIFICA, NYMPH. 148. LABIUM. 149. ABDOMEN. 150. SEGMENTS 8-10 OF ABDOMEN, VENTRAL VIEW. 151. "FACE". 152. LATERAL VIEW OF HEAD. 153. ANTENNA.

FIGS. 154-158.—MACROMIA ILLINOIENSIS, NYMPH. 154. LABIUM. 155. ABDOMEN. 156. SEGMENTS 8-10 OF ABDOMEN, VENTRAL VIEW. 157. LATERAL VIEW OF HEAD. 158. ANTENNA.

The nymph of this species was described in 1890 by Cabot,[1] who gives a fair figure, but whose description, probably from the lack of sufficient material, does not indicate the few points which distinguish this nymph from that of *illinoiensis*. Cabot's type was obtained at Umatilla, Oregon, probably in the Umatilla River, rather than the Columbia (the town of Umatilla is on the bank of the Columbia at the mouth of the Umatilla), for the banks and bed of the Columbia at this point are barren of vegetation. Cabot's determination of the nymph of *magnifica* was omitted from Williamson's[1] review of the

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[1] Cabot, Louis. Immature stages of the Odonata: Cordulina. Mem. Mus. Comp. Zool., vol. 17, 1890, p. 18, pl. 2, figs. 2, 2*a*.

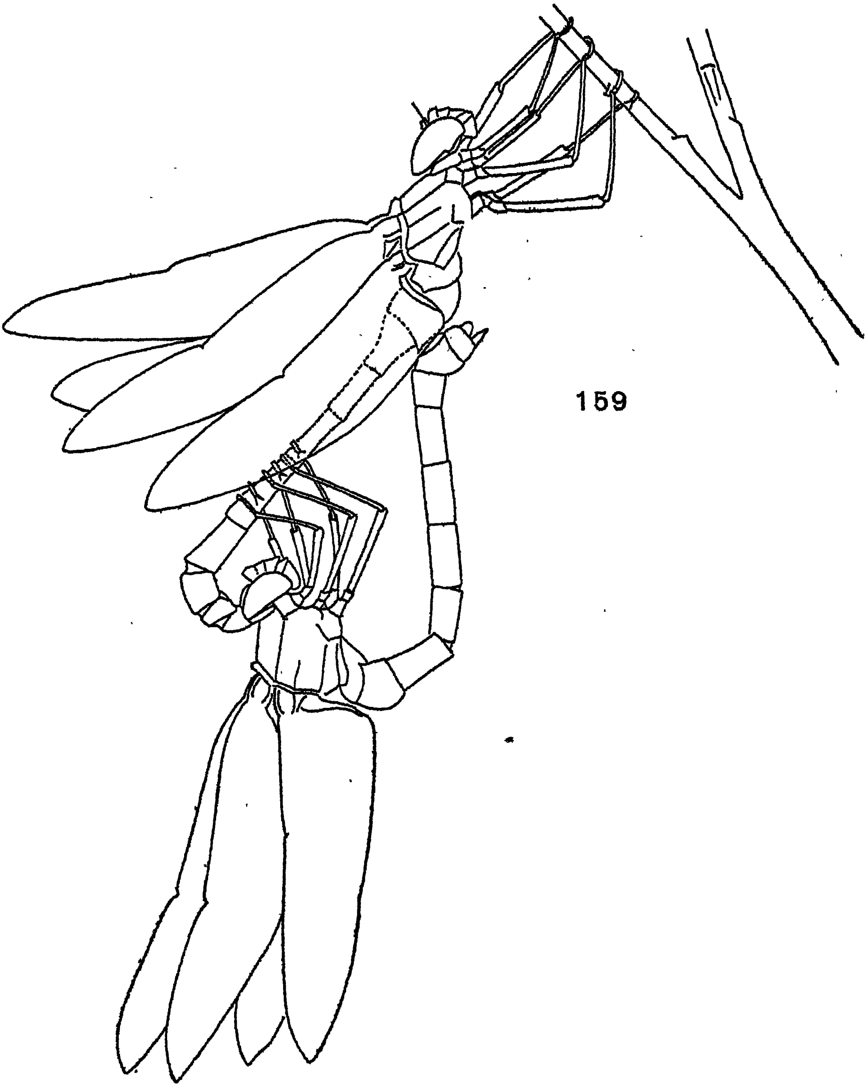

FIG. 159.—MACROMIA MAGNIFICA, COPULATION.

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[1] Williamson, Edward Bruce. The North American dragonflies (Odonata) of the genus Macromia. Proc. U. S. Nat. Mus., vol. 37, No. 1710, pp. 369-398, pls. 35, 36, Dec. 14, 1909.

genus and from Muttkowski's[1] Catalogue of the Odonata of North America because of its uncertainty, Cabot having called it *magnifica* because he had a female *magnifica* from the same locality.

While I have neither reared this species nor collected it while in the act of emerging, I feel sure that the single nymph and the 14 skins taken are *magnifica* for the following reasons: (1) I took 12 males and 2 females of *Macromia magnifica* on this stream in the same mile-long stretch in which the nymph and skins were collected; (2) no other species of Macromia was taken on the creek and none other has been taken in the State of Washington (I have a female *magnifica* from Lake Washington, Seattle, and Dr. E. M. Walker writes that *magnifica* has recently been taken in southern British Columbia); and (3) the nymph and skins were very evidently conspecific, as all agreed in the described peculiarities.

I wish here to thank Doctor Walker for the material of *Macromia illinoiensis* Walsh used in the following comparative description. This description is based on the single nymph deposited in the United States National Museum, but it applies equally well, except in color, to the 14 nymphal skins.

Nymph.—Length, 31 mm.; length of abdomen, 20, width, 11.5; width of head, 8; length of hind femur, 13.5 (in skins, 14); length of antenna, 5.

Head broader than long, with short appressed hairs on the anterior horn, on the bases of the antennae, and on the sides below and behind the eyes. Horn acute, densely hairy, and more erect than in *illinoiensis* (fig. 152, *magnifica;* fig. 157, *illinoiensis*). Eyes very prominent (see fig. 151), but hardly more so than in *illinoiensis.* Antennae (fig. 153, *magnifica;* fig. 158, *illinoiensis*) with first three joints enlarged, second and third joints hairy, fourth joint the longest, fifth the shortest. The whole length of the antenna slightly greater than that of *illinoiensis.* On each hind angle of the head a prominent superior tubercle, which is more sharply defined than in *illinoiensis* (fig. 152, *magnifica;* fig. 157, *illinoiensis*). Sides of mentum straighter, and posterior angles less rounded than in *illinoiensis* (fig. 148, *magnifica;* fig. 154, *illinoiensis*). Usually two setae at base of each lateral lobe on the inner face in *illinoiensis* and but one in *magnifica.* In *magnifica* the mental setae are usually four in a short row on either side, followed at its inner end by a single detached seta, between which and the median line are from one to four shorter irregularly placed setae. In *illinoiensis* each main row of mental setae usually contains five, with a single detached seta at its inner end, and other short irregularly placed setae between it and the median line (fig. 148, *magnifica;* fig. 154, *illinoiensis*).

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[1] Muttkowski, Richard A. Catalogue of the Odonata of North America. Bull. Pub. Mus. Milwaukee, vol. 1, art. 1, pp. 207, May, 1910, issued June 27, 1910.

Abdomen very similar to that of *illinoiensis* but differing in three particulars: (1) The dorsal spines of segments 2 and 3 are straight, whereas they are slightly hooked in *illinoiensis* (fig. 149, *magnifica;* fig. 155, *illinoiensis*). (2) The lateral spines on segment 9 do not reach the posterior margin of segment 10, whereas in *illinoiensis* they surpass segment 10 (fig. 150, *magnifica;* fig. 156, *illinoiensis*). (3) The posterior edge of the sternum of segment 9 is fringed with hairs, whereas in *illinoiensis* there are seldom more than two to four short hairs to be found on this edge (fig. 150, *magnifica;* fig. 156, *illinoiensis*).

General color of live nymphs dirty olive, in detail as follows (see figs. 146 and 147): Antennae pale, no markings. Frontal horns dark. Eyes and triangular areas between them, which represent the adult eyes, dark. Parts of head posterior to eyes pale. Dorsal surfaces of thorax and wing pads dark brown, which, excepting the eyes, are the darkest areas of the nymph. Legs with three bands on the femur; tibiae dotted, with hind legs the darkest. Dorsal surface of abdomen mottled and speckled with olive brown, with a more or less well defined spot on the outer end of each segment. All ventral surfaces of the larva pale.

In Needham's key to nymphs of *Macromia*,[1] *magnifica* would come under division "*a*." Thus:

a^1. Lateral spines of abdomen directed posteriorly, hardly incurved. Pyramidal frontal horn acute at apex.
  b^1. Dorsal spines on abdominal segments 2 and 3 straight................*magnifica*.
  b^2. Dorsal spines in abdominal segments 2 and 3 slightly hooked at tip..*illinoiensis*.
a^2. Lateral spines of abdomen strongly incurved at tip. Pyramidal horn on front of head obtuse..*taeniolata*.

I have taken *magnifica* in California on Coyote Creek in Santa Clara County, where it emerged early in May and was on the wing about six weeks; also on Chico River, on a small creek near Oroville, June 12, and on the asylum grounds at Napa, June 8. Numerous exuviae have been found at these places and none over 2 feet above the water.

5. SOME LISTS OF ODONATA COLLECTED IN WASHINGTON AND OREGON FROM 1909 TO 1913.

The fifth part of this paper is devoted to lists of Odonata from various localities in which I have collected in Washington and Oregon. Various notes on habits of imagoes and descriptions of nymphal stages have been inserted in these lists as being the most logical place for them.

BAKER VALLEY, OREGON.

During the summer of 1909 I collected in the Baker Valley of eastern Oregon. This valley lies at an elevation of 3,400 feet in the Blue Mountains. The floor of the valley lies in the sagebrush, but on the west side rise the timber-covered Elkhorn Mountains. The Powder River winds through the center of the valley, but after the first run-off of snow water this stream is hardly more than a succession of gravel bars, with but little odonate life. The channel of the river, however, is higher than either side of the valley floor, which makes, on each side of the valley and parallel with the river,

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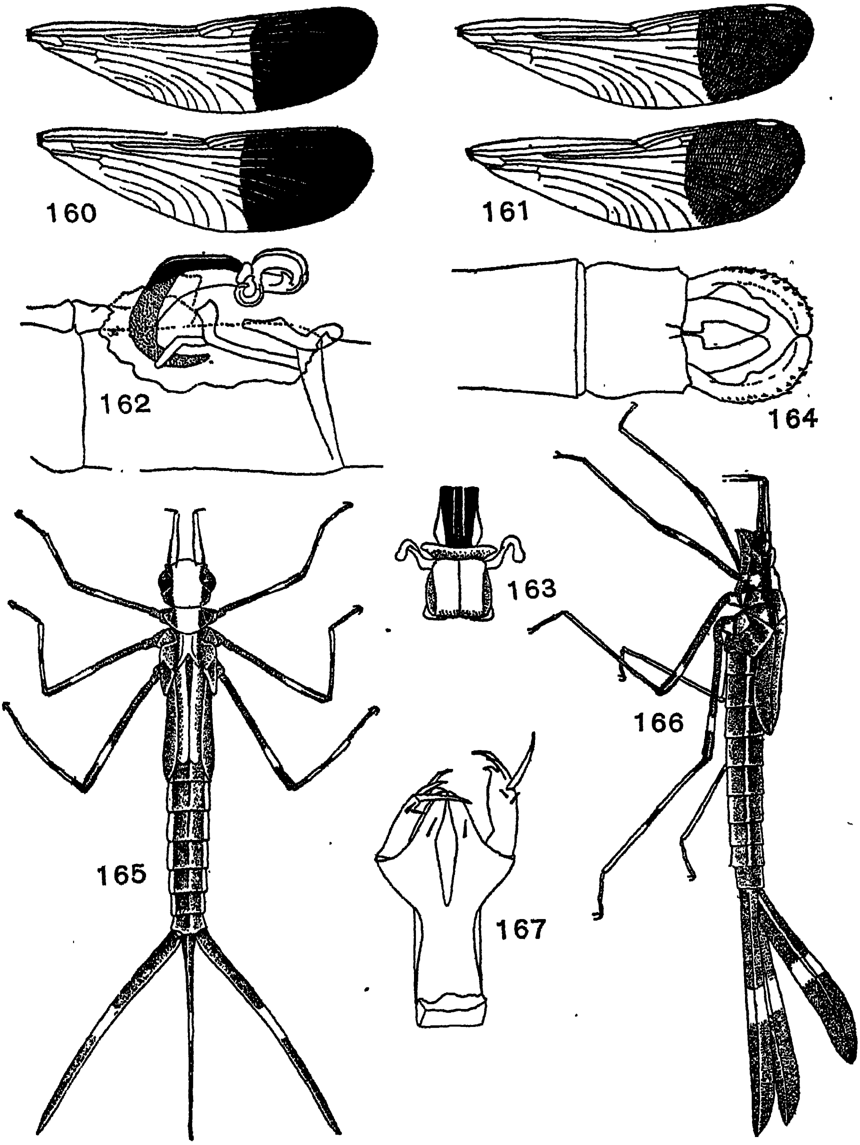
[1] Needham, James G., and Betten, Cornelius. Aquatic Insects of the Adirondacks. Bull. 47, N. Y. State Mus., pp. 612, September, 1901. See p. 483.



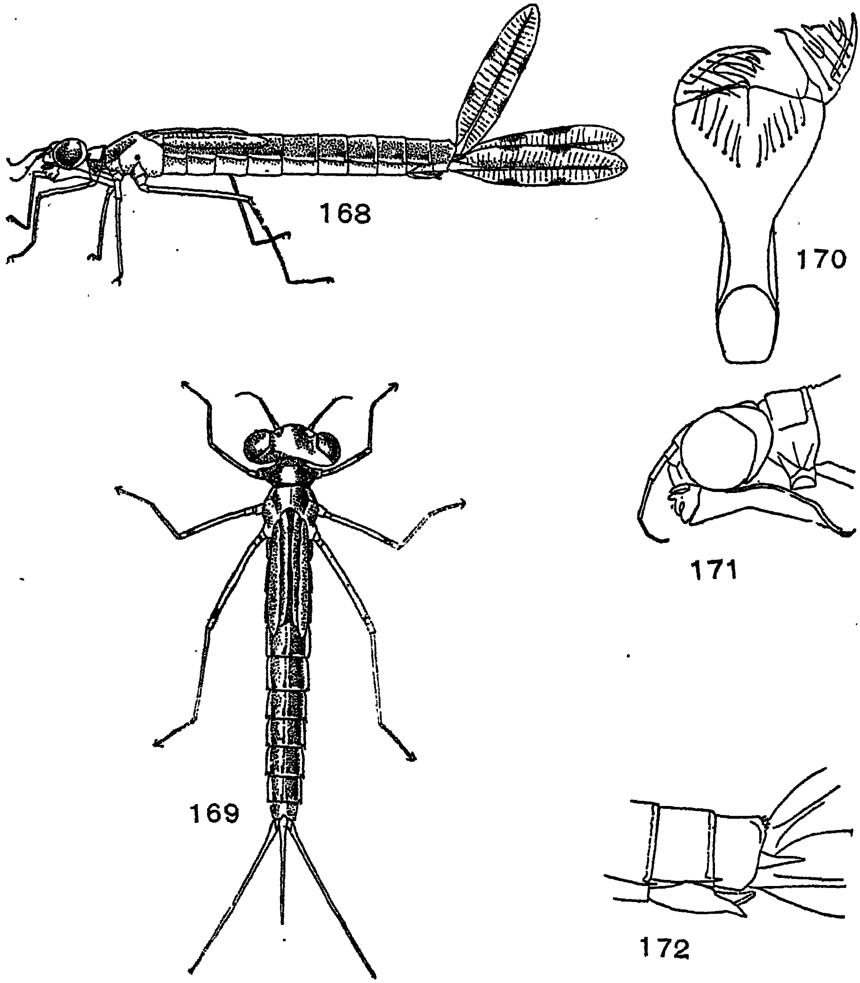
FIGS. 160-167.—AGRION AEQUABILE YAKIMA. 160-161. WINGS OF MALE AND FEMALE SHOWING EXTENT OF COLOR. 162. SEGMENT 2 OF MALE. 163. PENIS. 164. MALE APPENDAGES. 165-166. NYMPH. 167. DORSAL VIEW OF LABIUM OF NYMPH.

a slough that empties into the river at the foot of the valley. These sloughs are alkaline, though with a sluggish current.

The following species were taken on the William Hindman ranch 4 miles west of Baker City on the west slough during July, 1909:

1. **LESTES CONGENER Hagen.**

One male specimen.



FIGS. 168–172.—LESTES CONGENER, NYMPH. 168. LATERAL VIEW. 169. DORSAL VIEW. 170. LABIUM. 171. HEAD, LATERAL VIEW. 172. SEGMENTS 9 AND 10.

2. **LESTES UNCATUS Kirby.**

This was common about the stagnant alkaline pools.

3. **LESTES UNGUICULATUS Hagen.**

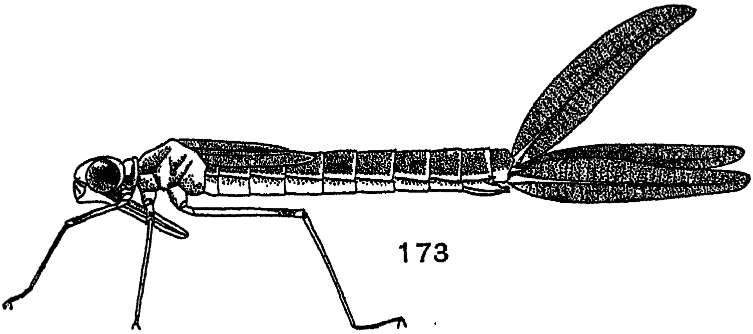
This occurred commonly with the preceding species.

4. **LESTES DISJUNCTUS Selys.**

Two males of this species were taken.

5. **ENALLAGMA ANNA** Williamson.

Common, breeding on the fresher of the stagnant pools.



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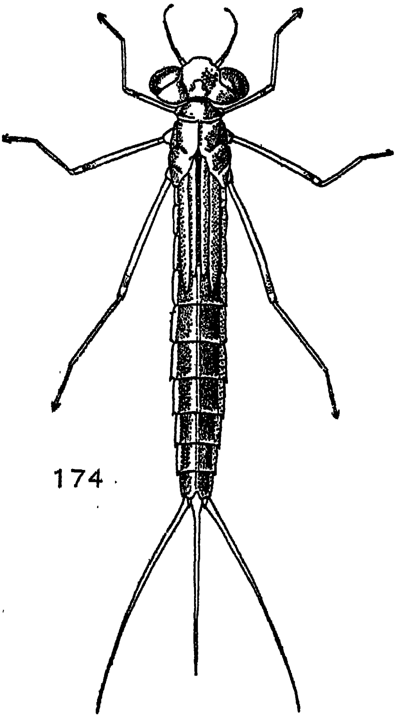

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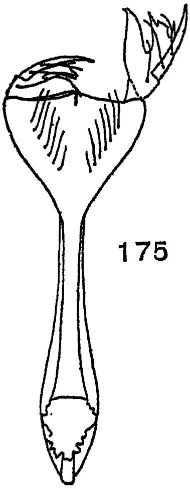

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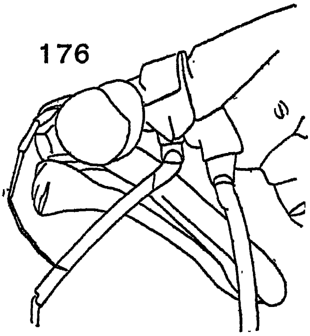

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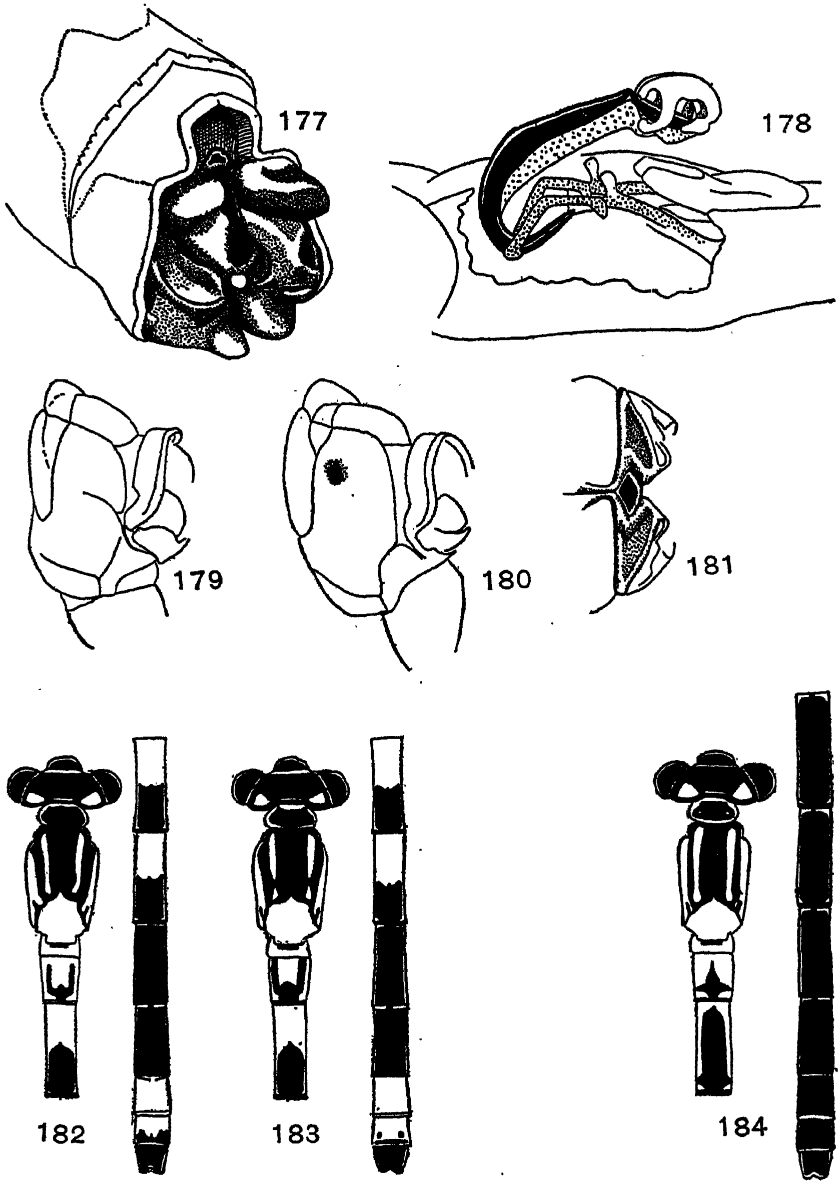
FIGS. 173-176.—LESTES UNCATUS, NYMPH. 173. LATERAL VIEW. 174. DORSAL VIEW. 175. LABIUM. 176. HEAD.

6. **ENALLAGMA CALVERTI** Morse.

Common, associated with *anna* but earlier.

7. **ENALLAGMA CYATHIGERUM** (Charpentier).

One male taken.



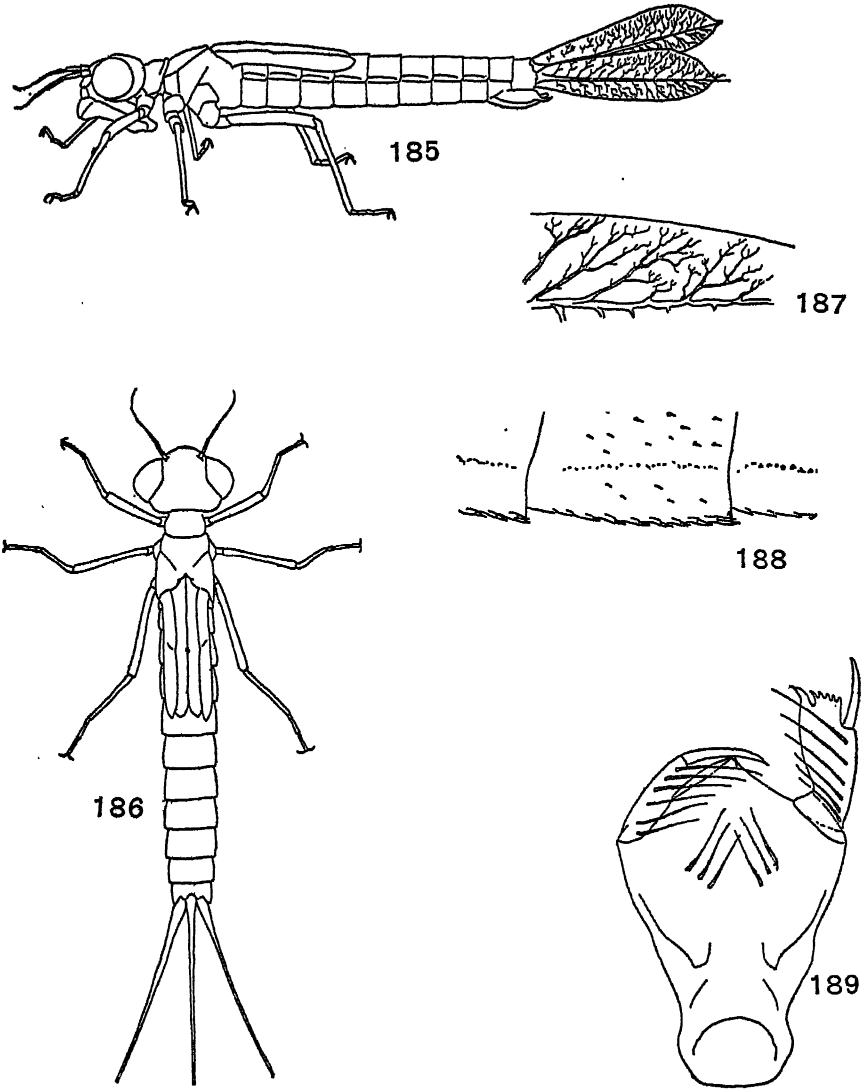
Figs. 177–184.—Coenagrion resolutum. 177. Male appendages. 178. Segment 2 and penis. 179. Male prothorax. 180. Female prothorax showing the right dorsal "pit" (in black). 181. Mesostigmal lamina. 182–183. Male color patterns. 184. Female color pattern.

8. AMPHIAGRION SAUCIUM (Burmeister).

This was the earliest and most abundant species. It had largely disappeared by July 1, when the season was opening for the other species.

9. ISCHNURA CERVULA Selys.

This was at the height of its abundance during the last part of June and the first part of July.



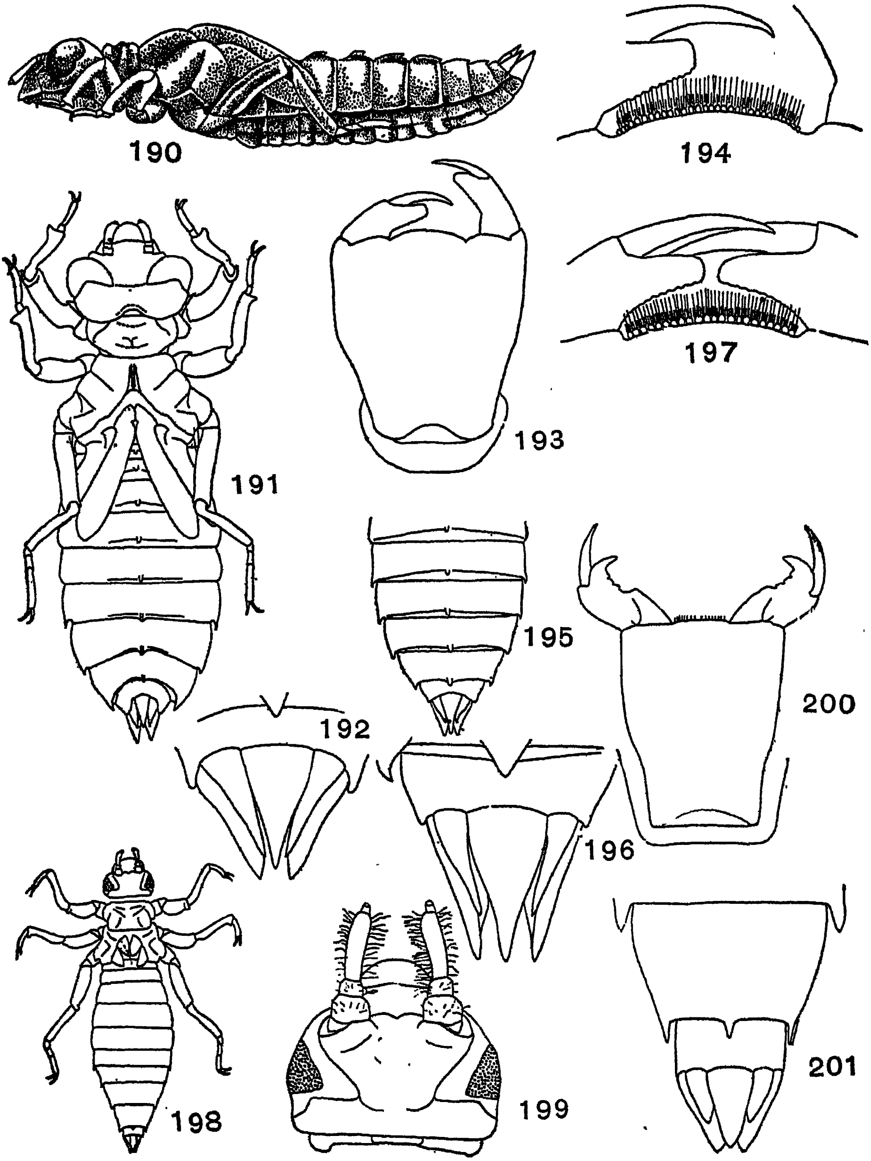
Figs. 185-189.—Coenagrion resolutum, nymph. 185. Lateral view. 186. Dorsal view. 187. Detail of caudal gill. 188. Lateral fold of abdomen showing the spinulose edge. 189. Labium.

10. ISCHNURA PERPARVA Selys.

Found throughout the summer but not abundant.

11. AESHNA INTERRUPTA INTERNA Walker.

This species came out during July but was not so abundant as the next species. On the wing it appeared gray.



FIGS. 190-194.—OPHIOGOMPHUS SEVERUS, NYMPH. 190. LATERAL VIEW. 191. DORSAL VIEW. 192. SEGMENT 10. 193-194. LABIUM.

FIGS. 195-197.—OPHIOGOMPHUS OCCIDENTIS, NYMPH. 195. ABDOMEN, DORSAL VIEW. 196. SEGMENT 10. 197. LABIUM.

FIGS. 198-201.—GOMPHUS SP. 198. DORSAL VIEW. 199. HEAD. 200. LABIUM. 201. SEGMENTS 9 AND 10.

12. **AESHNA UMBROSA OCCIDENTALIS** Walker.

This species was very abundant during the latter part of July. It was first seen July 10.

13. **LIBELLULA QUADRIMACULATA** Linnaeus.

Two specimens of this species were seen during August. One was taken.

14. **LIBELLULA PULCHELLA** Drury.

This species was common but not abundant at any place.

15. **SYMPETRUM CORRUPTUM** (Hagen).

One pair was taken.

16. **SYMPETRUM COSTIFERUM** (Hagen).

Common, but not so abundant as *decisum*.

17. **SYMPETRUM OBTRUSUM** (Hagen), var. **DECISUM** (Hagen).

The most abundant of the Sympetrums.

18. **SYMPETRUM MADIDUM** (Hagen).

This species was common during June and July but was not taken during August.

19. **SYMPETRUM PALLIPES** (Hagen).

Several specimens taken. Not common.

20. **SYMPETRUM SCOTICUM** (Donovan).

This species appeared during the first week in August. It was at first very abundant in a grassy slough. The individuals soon spread from this over a wide territory.

EAGLE VALLEY, OREGON.

From September 7 to 19, 1909, I collected at New Bridge, Baker County, Oregon, in a small valley called Eagle Valley. Here the collecting was done along the banks of Eagle Creek, but the specimens collected came from a series of sloughs more or less alkaline, which ran parallel to the creek. The creek was a cold gravel-bottomed mountain stream almost dry from its waters having been used for irrigation in this part of its course. This valley was lower (2,500 feet altitude) and warmer than Baker Valley.

1. **LESTES UNGUICULATUS** Hagen.

Several specimens taken.

2. **ENALLAGMA ANNA** Williamson.

Several taken.

3. **AMPHIAGRION SAUCIUM** (Burmeister).

Several taken.

4. **ISCHNURA CERVULA** Selys.

Occasional.

5. **ISCHNURA PERPARVA** Selys.

Common.

6. **AESHNA PALMATA** Hagen.

This species was common. No tenerals were seen. It was in company with *Aeshna umbrosa occidentalis* and had apparently identical habits, as both patrolled the smaller, more stream-like sloughs, especially where these were surrounded by trees. Both seemed to prefer such sunny glades to the more open spaces. In both species the males were much more abundant than the females.

7. AESHNA UMBROSA OCCIDENTALIS Walker.

Of the two species of *Aeshna* this was the more abundant. This material in *Aeshna* from eastern Oregon has been identified by Dr. E. M. Walker, and in his monograph[1] further notes can be found on it.

8. LIBELLULA PULCHELLA Drury.

Common.

9. SYMPETRUM COSTIFERUM (Hagen).

Common.

10. SYMPETRUM OBTRUSUM (Hagen).

This was common in the blue-grass pasture back of Mr. Blue's barn, but not so abundant as the next. This small white-faced *obtrusum* was only found here. At all other places in which collections were made the variety *decisum* was taken.

11. SYMPETRUM OBTRUSUM (Hagen), var. DECISUM (Hagen).

Abundant.

12. SYMPETRUM MADIDUM (Hagen).

One specimen taken.

13. SYMPETRUM PALLIPES (Hagen).

Common.

14. SYMPETRUM SCOTICUM (Donovan).

Very abundant.

15. SYMPETRUM SEMICINCTUM (Say).

Found only about Mr. Blue's ice pond. This species was not found in either Baker or Pine Valleys.

PINE VALLEY, OREGON.

From September 20 to 23 I collected in Pine Valley, Baker County, Oregon. This is a high cold valley (3,000 feet elevation) but has a greater rainfall than Baker Valley. A heavy frost occurred at Pine Town on September 21. The dragonfly season was practically over. The following species were taken: *Aeshna umbrosa occidentalis* Walker, *Sympetrum pallipes* (Hagen), and *S. scoticum* (Donovan).

GRANDE RONDE VALLEY, OREGON.

On September 30, 1909, I collected in Grande Ronde Valley near La Grande, Oregon. I took the following species: *Aeshna umbrosa occidentalis* Walker, *Sympetrum costiferum* (Hagen), *S. obtrusum* (Hagen), *S. obtrusum* (Hagen) var. *decisum* (Hagen), *S. scoticum* (Donovan), and *S. pallipes* (Hagen).

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[1] Walker, E. M. The North American Dragonflies of the Genus Aeshna. Univ. of Toronto Studies, Biol. Ser., No. 11, Toronto, pp. 213, pls. 28, text figs. 7, 1912.

LIBERTY LAKE, WASHINGTON.

On July 4, 1912, I collected at Liberty Lake in the Mica Mountains, east of the city of Spokane, Washington.

The Mica Mountains rise about 1,000 feet above Spokane Valley and are covered with pine timber. The foothills and the Spokane Valley floor lie in the sage brush. Liberty Lake is a narrow body of water 2 miles long and three-fourths of a mile wide lying in the outer end of a deep V-shaped ravine running back into the mountains. The upper end of the lake is in the timber, the lower end in the sage brush. The shores of the lake are steep, except at outlet, where the water flows sluggishly through low weedy banks, and the upper end, where there is a triangular marsh of about 20 acres in extent. The following species were taken:

1. **ENALLAGMA CARUNCULATUM** Morse.

Several taken in outlet.

2. **ENALLAGMA CYATHIGERUM** (Charpentier).

Found in outlet.

3. **ENALLAGMA EBRIUM** (Hagen).

This was very abundant in the *Scirpus* fringing the lake shore along the swamp at its upper end.

4. **AMPHIAGRION SAUCIUM** (Burmeister).

A few were taken about the outlet.

5. **ISCHNURA CERVULA** Selys.

Several seen in the outlet.

6. **ISCHNURA PERPARVA** Selys.

Common in the outlet.

7. **AESHNA UMBROSA OCCIDENTALIS** Walker.

Four male nymphs and one female nymph of this species were found in the outlet. These were very kindly identified by Doctor Walker. Several Aeshnas were seen on the wing but no adults were taken.

8. **TETRAGONEURIA SPINIGERA** Selys.

Several were captured in the swamp at the head of the lake.

9. **LIBELLULA QUADRIMACULATA** Linnaeus.

Several were seen in the swamp at the head of the lake.

10. **LIBELLULA FORENSIS** Hagen.

This species was common in the outlet.

11. **SYMPETRUM CORRUPTUM** (Hagen).

Two specimens were captured in the outlet.

12. **SYMPETRUM OBTRUSUM** (Hagen), var. **DECISUM** (Hagen).

Emerging in large numbers in the swamp.

13. **SYMPETRUM PALLIPES** (Hagen).

Emerging from the swamp in numbers.

PALOUSE VALLEY, WASHINGTON.

During June of 1913 Prof. C. E. Farr, of Sunnyside, Washington, took the following species in the Palouse Valley: *Enallagma cyathigerum* (Charpentier), *Amphiagrion saucium* (Burmeister), *Ischnura cervula* Selys, and *Ischnura perparva* Selys.

During August of 1914 Professor Farr collected the following on Union Flat Creek, Palouse, Washington: *Argia emma* Kennedy, *Ischnura cervula* Selys, *Ischnura perparva* Selys, *Enallagma calverti* Morse, *Libellula pulchella* Drury.

SHERMAN, OREGON, IN THE COLUMBIA RIVER GORGE.

During the first week in July, 1913, I made a short trip up the Deschutes River to Bend, Oregon.

My first stop was made on July 2 in the Columbia River Gorge at Sherman, Oregon. Here the Columbia River, a half mile broad, flows through a gorge from 1,500 to 2,000 feet deep. The sides are precipitous brown hills, barren except that here and there is a green spring-fed ranch on some bench 500 or 1,000 feet above the river. The bottom of the gorge on either side is a narrow strip of white sand dunes. Among these is the box-car station called Sherman. The collecting at this point was done in a narrow lateral ravine, up which the Y of the Deschutes River ran. A half mile from the Columbia this ravine becomes a rocky gorge. I collected in the more open mouth of the ravine, where the cool spring-fed stream coming down from above runs through a succession of shallow boggy ponds. At this point, during the two hours I had to wait for the Deschutes train, I took the following species:

1. **ARGIA VIVIDA Hagen.**

This was the most abundant species, the majority apparently having recently transformed, as many tenerals were found. This species fairly swarmed over the smooth round bowlders scattered everywhere along the course of the stream. It was abundant also along the bank of the Columbia east of the mouth of the lateral ravine, whither it had evidently been carried by the half gale which blows up the Columbia daily. This species was not seen copulating or ovipositing.

2. **ENALLAGMA CYATHIGERUM (Charpentier).**

A few were found about some of the larger pools well back in the ravine.

3. **AMPHIGRION SAUCIUM (Burmeister).**

Amphiagrion was very abundant about a single pool not far from the beach of the Columbia. This pool was very thickly grown up with sedges. Breeding was in progress.

4. **ISCHNURA PERPARVA Selys.**

Common in the sedges with *Amphiagrion*.

5. **OPHIOGOMPHUS OCCIDENTIS** Hagen.

A single specimen was taken on the bank of the Columbia at the mouth of this ravine. It was the only one seen.

6. **ANAX JUNIUS** (Drury).

I did not capture one of these, but one or two were coursing up and down the ravine. I feel sure of the identification.

7. **LIBELLULA FORENSIS** Hagen.

Several were seen and one was taken.

8. **LIBELLULA PULCHELLA** Drury.

One was seen.

9. **ERYTHEMIS SIMPLICICOLLIS** (Say).

Three were seen.

10. **SYMPETRUM CORRUPTUM** (Hagen).

Four were seen. One was taken.

BIG MEADOWS, BEND, OREGON.

From Sherman I went by train up the Deschutes Canyon to Bend, Oregon.

The Deschutes is the largest tributary of the Columbia from central Oregon. Arising at an elevation of over 4,000 feet, in the 300 miles of its course to the Columbia it falls over 13 feet to the mile, making it a swift boisterous stream flowing for the greater part of its distance through a canyon from 1,000 to 3,000 feet deep. During the three hours' train ride through this canyon observation showed but two or three tributaries and these were merely very small spring-fed streams. About half way up the canyon at Hunter's Ferry several very large springs burst from the walls of the canyon and may have supported odonate species in their short courses to the river, but rainy weather prevented my stopping there.

At the town of Gate Way the railroad leaves the canyon and through a lateral gorge emerges onto the central Oregon plateau, which is a barren, brown, sage-covered region with here and there low ridges or detached volcanic buttes. To the west lie the blue timber-covered Cascades above which tower the white cones of several volcanic peaks. South of Bend, the Valley of the Deschutes is wide and shallow and lies in the timber, which covers the eastern slope of the Cascades. The river, where examined at its mouth on the Columbia and at Bend, was practically devoid of odonate life. The season was late and the water was high.

On the Deschutes 18 miles south of Bend lie the Big Meadows, which are about 1,000 acres in extent, and which, in contrast to the rarity of Odonata elsewhere on the river, fairly swarm with dragonflies. At a recent time geologically a volcanic eruption has occurred on the east slope of the valley at what is now the lower end of the Meadows. Here is a small cinder cone, from whose base radiates a lava field of several sections in extent, which has flowed down into the Deschutes gorge damming the river so that its present bed is 500 or 600 feet above the primitive channel. The lake, which was formed back of this dam, is now filled with sediment and forms the Big Meadows. These lie at an elevation of 4,000 feet, and a frost had occurred there on July 4. The Meadows are surrounded by yellow and jack pine over the western rim of which rises the snow-capped Bachelors Peak. Several shallow sloughs, which are filled by springs and by high stages of the river, occur here and each is a favorite resort of special species.

I spent four days here (July 4–7) at the ranch of Mr. F. A. Shonquest, who helped me in various ways. The following is a list of the species found:

1. AGRION AEQUABILE (Say).

One specimen was seen on the meadow near Mr. Shonquest's meadow road. One, a female teneral, was taken just above the lava dam (Denham Falls). At the time I took this I thought it the variety *yakima*, but it has faded until now it is impossible to determine the subspecies. As the numbers of *aequabile* reached their height later than this on the warmer Satus Creek, Washington, I believe this an early date for the species here.

2. LESTES UNCATUS Kirby.

Very abundant in sedges along the river and in the first slough across the river from Shonquest's. The adults are rich blue-green. Breeding, but still emerging in large numbers. Though described by Needham, because of the abundance of material I have figured the nymph.

Nymph (figs. 173–176).—Needham[1] has listed the nymph of *Lestes uncatus* in a key to the species of *Lestes*, but he does not distinguish it from the nymph of *unguiculatus*. Whether it can be distinguished on further study I do not know, as I have no nymphs of *unguiculatus*. But as I had excellent specimens of both nymphs and skins of *uncatus* I have thought it best to figure this nymph, which differs in various ways from the nymph of *congener* (figs. 168–172).

This nymph is more slender than that of *congener* and considerably larger. Its measurements are as follows: Head, 4 mm. wide, 2 mm. long; length of head, thorax, and abdomen, 28; gills, 10 extra; abdomen, 13.5; hind femur, 5.

In this species the folded labium (fig. 175) is very slender, its hinge reaching caudad beyond the metathoracic coxae (see figs. 173 and 176), whereas in *congener* (figs. 168, 170, 171) it reaches barely to the mesothoracic coxae. The basal two-thirds of the mentum is almost triangular in outline. There are normally seven mental setae, though one specimen had only six. There are two setae on the movable hook of the lateral lobe and a single seta on the inner face of the base of the lateral lobe. The eyes are relatively large, occupying two-fifths of the width of the head. Segments 6–9 have a well-defined spine on each side at the posterior end of the lateral keel. Segment 5 has usually a pair of small spines. Segments 1–4 are without spines.

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[1] Needham, James G., MacGillivray, Alex. D., Johannsen, O. A., and Davis, K. C. Aquatic Insects in New York State. Bull. 68, N. Y. State Mus., pp. 517, pls. 52, text figs. 26, 1903. See p. 233.

The gills (see fig. 173) are slightly asymmetrically lanceolate, with rounded tips. The middle gill is wider than the lateral gills and curves downward. The lateral gills curve upward.

In life the larvae (figs. 173 and 174) were dusky olive green. The legs show a slight band around the end of the femur. There is a pale stripe along each side of the abdomen. In some specimens there is a narrow middorsal white stripe, in others a row of faint darker spots along the sides. The gills are uniformly dark, a few specimens showing slightly darker spots on the edges of the lateral gills.

Figures 173 and 174 show dorsal and lateral views of the nymph, and figures 175 and 176 show details.

3. ENALLAGMA CYATHIGERUM (Charpentier).

This species occurred in the sedges along the river bank, but was nowhere abundant.

4. COENAGRION RESOLUTUM (Hagen).

This species (figs. 177–184) was very abundant in the sedges and patches of *Equisetum* bordering the river itself. I found many females, evidently in a teneral stage, but only two exuviae. The teneral females had the sides of the thorax and femora pink. In the male the blue humeral stripes in about one-fourth of the specimens were interrupted as is shown in figure 183. As I can find no figures of the anatomical details of this species I have figured various parts (see figs. 177–181). The mesostigmal lamina of the female (fig. 181) is especially large and well developed.

Because I found only two exuviae and but few very young tenerals, I believe that all individuals of this species, at least in this locality, must emerge at about the same time and that this general emergence had been previous to my arrival. Of the exuviae one was taken by itself a few inches above the surface of the water, the other was found on a stem of Carex, on the top of which rested a teneral female. The only other species found in the meadows with whose exuviae they might be confused were *Ischnura perparva, Ischnura cervula,* and *Enallagma cyathigerum.* They are not the exuviae of any of these species.

Nymph (figs. 185–189).—Length (excluding gills), 15 mm.; gills, 8 extra; abdomen, 8; hind femur, 3.

The nymph (figs. 185 and 186) is slender, between those of *Argia* and *Enallagma* in slenderness. The head (see fig. 186) is broad, very flat on the dorsal surface, and very slightly emarginate behind. The antennae are one-fourth longer than the head. The labium (fig. 189) is very similar to that of an *Enallagma.* The anterior edge is produced forward and downward into an acute angle. Three mental setae on each side; six long raptorial setae on each lateral lobe. Each lateral lobe terminates distally in a hook, which is separated by a deep cleft from the terminal row of five short teeth.

The legs are moderate in length, with three low keels on femur and tibia. Wing cases long, reaching to the middle of segment 4, slender and held parallel. Abdomen with large lateral keels, which are denticulate with minute teeth. (See fig. 188.) Gills (see figs. 185 and 187) oblanceolate.

The coloration is so obscure that I will not attempt to describe it.

The nymph is of a generalized form lying near to the nymphs of *Enallagma,* but is peculiar in having the denticulate lateral keels.

These specimens are deposited in the United States National Museum.

5. AMPHIGRION SAUCIUM (Burmeister).

This species was common, but nowhere in swarms as it is frequently found in such situations.

6. ISCHNURA CERVULA Selys.

One or two individuals of this species were taken each day. The meadows were probably too high and cold for it.

7. ISCHNURA PERPARVA Selys.

A few specimens of this were taken.

8. OPHIOGOMPHUS MORRISONI Selys.

One specimen, a male, was taken on a sandy bank of the river. Two other specimens, probably this species, were seen on Mr. Shonquest's corduroy road.

9. ANAX JUNIUS (Drury).

One specimen was seen late in the afternoon beating back and forth over one of the sloughs.

10. AESHNA INTERRUPTA INTERNA Walker.

One female was taken in the timber near the meadows. As this was a teneral and, excepting one male, the only *Aeshna* seen, it was probably early for Aeshnas.

11. CORDULIA SHURTLEFFI Scudder.

One male taken over a grassy slough near Mr. Shonquest's bridge. A female was taken in the bushes just above Denham Falls.

12. SOMATOCHLORA SEMICIRCULARIS (Selys).

This species was very common over those grassy sloughs in which sedges grew up through from 6 inches to 2 feet of water. Usually, too, these were surrounded by timber in which the Somatochloras took occasional side flights, especially late in the afternoon, when they seemed to prefer the sunny tops of the trees to the cooler sloughs. I took 80 males and only 2 females. The females were probably more abundant, but because of their gray colored eyes and plump abdomen they were indistinguishable from the swarm of *Libellula quadrimacu-*

lata which always hovered over the sloughs. The two females taken were scooped up accidentally. The males were distinguishable on the wing endwise by their bright green eyes and sidewise by their curved abdomen. None of the specimens were tenerals. In these specimens the spots on the side of the abdomen were minute points. All degrees of striping of the nasus occurred.

13. **LIBELLULA FORENSIS Hagen.**

This was not common. I took one specimen at Denham Falls.

14. **LIBELLULA QUADRIMACULATA Linnaeus.**

I have never elsewhere seen a large species of dragonflies as abundant as was this species. Over the same grassy sloughs as those occupied by Somatochloras, these Libellulas were a constant annoyance during collecting, either disturbing other species or imitating their flight.

15. **SYMPETRUM CORRUPTUM (Hagen).**

I took two frayed females on the meadows.

16. **SYMPETRUM MADIDUM (Hagen).**

The males and females of this species are seldom found associated except at time of emergence. The males were common along the higher open banks of the sloughs, where I saw no females, and the females could always be found on the corduroy road, where I saw no males. (On lower Satus Creek, Washington, I have never taken a male, but females were common.) None of the specimens were teneral.

17. **SYMPETRUM OBTRUSUM (Hagen).**

Several specimens were taken in the early red, which were probably *obtrusum*.

18. **SYMPETRUM OBTRUSUM (Hagen), var. DECISUM (Hagen).**

This variety was swarming out of the sloughs more directly connected with the river channel. All were teneral. Some seemed intermediate between this and *obtrusum*, the face being white with an olive cast. Two females had wings yellow to beyond the nodus. All the specimens showed more than the usual amount of yellow at the base of the wings.

19. **SYMPETRUM PALLIPES (Hagen).**

This species was emerging in large numbers. None but tenerals were taken.

20. **LEUCORRHINIA HUDSONICA (Selys).**

This species was common in the sloughs, where the grass was more open so that the surface of the water was exposed. They spent most of their time seated on the tops of aquatic plants. They copulated on the wing, the male picking up the female as she sat on some plant. The flight was short, after which the male dropped the female but hovered near, while she oviposited by tapping the tip of her abdomen repeatedly on the surface of the water.

21. **LEUCORRHINIA INTACTA (Hagen).**

This species occurs with *hudsonica* but was not so abundant.

UMATILLA, OREGON.

On my return from the Deschutes I collected at Umatilla, Oregon, on July 8 and 9. Umatilla is a railroad yard among the sandhills at the mouth of the Umatilla River. A gale was blowing during this time but I found the following species: *Enallagma carunculatum* Morse, *Ophiogomphus occidentis* Hagen, *Ophiogomphus severus* Hagen, *Aeshna multicolor* Hagen, *Libellula forensis* Hagen, and *Sympetrum semicinctum* (Say).

All the species were stragglers except *Ophiogomphus occidentis*. This species was emerging in numbers on the point of land separating the down-stream side of the Umatilla River from the Columbia. From the place of their emergence it appeared that the nymphs lived in the bay or open mouth of the Umatilla River, where they were on a mud bottom and not exposed to the main current of either river. Though the banks of both rivers were searched for some distance none were found emerging elsewhere. Because of the high wind they were easily captured while hanging to the sage bushes among which they had taken refuge. Numerous exuviae were found on the beach and on plants and brush lying in the water. Figures 195–197 show details of the exuviae which have not hitherto been figured.

YAKIMA VALLEY, WASHINGTON.

Collecting in the Yakima Valley, Washington,[1] was done altogether in that part lying between Grandview and North Yakima. This part of the valley lies entirely in the sage brush and, excepting those parts now irrigated, has no mesophytic vegetation except the narrow fringe of trees along the Yakima River and its tributaries, and the swampy areas about the alkaline ponds in the Yakima River bottoms.

I have described Satus Creek in the section on *Argia vivida* and *Argia emma* (pp. 269–270). The Yakima River itself contains but little odonate life. It is a shallow stream during the irrigating season, when most of its water is withdrawn, and is easily forded every mile or so. In the more swift reaches it is gravel bottomed and in the bends mud bottomed. The alkaline ponds fall into two groups, the larger ones between Sunnyside and the Yakima River, the largest of which is Nigger Pond, a half mile long and an eighth mile wide, and the group of smaller fresh ponds near Donald.

1. AGRION AEQUABILE YAKIMA (Hagen) (figs. 160–167).

I saw one specimen of this near Outlook. Otherwise I took it only on lower Satus Creek, where it was abundant. Here it was first seen June 17. It reached its greatest numbers July 27. On August 7 few were seen, and none on August 17.

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[1] I have just found a male and female *Tachopteryx hageni* in the collections in the California Academy of Sciences. These are from Monroe, Washington, and will be described in my paper on collecting done in California and Nevada during 1914. Nevada is the type locality of this species.

Figure 160 shows the extent of the dark color on the wings of the male and figure 161 the extent of that on the wings of the female. The second segment of the male is shown in lateral view in figure 162, the penis in figure 163, and the appendages in figure 164. The nymph, shown in figures 165 and 166, is very similar to that of *Agrion maculatum* Beauvois but differs in having a less vivid color pattern. The pattern in life is in various shades of olive green, which dissolves out into the alcohol in which the specimens are placed.

Nymph (figs. 165–167).—Length, 24 mm.; gills, 16 additional; hind femur, 8.5; abdomen, 16; antenna, 5.5.

Head flat and broad. Basal segment of antenna scarcely as long as head is wide, longer than other six segments. Labium (fig. 167) bifid to below bases of lateral lobes. A short mental seta on either side of the cleft. Each lateral lobe with two short setae at base of lateral lobe. Each lateral lobe, besides the movable hook, with three end hooks. Abdomen with segments 1–9 with high lateral keels. No lateral spines on abdomen. Wing cases reaching beyond middle of fourth segment. Gills (see figs. 165 and 166) linear, the lateral gills longer than the median and thicker. Color olive, with an obscure broad lighter stripe on head and thorax. A longitudinal stripe on each lateral abdominal keel and a pale band on each femur, tibia, and gill.

The nymph of the variety *yakima*, then, differs from the eastern nymphs of *aequabile* as described by Needham[1] in its greater size and in having only two setae at the base of each lateral lobe, neither being characters of specific importance.

The female of this species oviposits by inserting the eggs under the water in willow roots. She is unaccompanied by the male but remains indifferent as various males hover over her.

2. ARCHILESTES CALIFORNICA McLachlan.

This species is found along the river and creeks from the first week in August until frost. It is most abundant on Satus Creek.

3. LESTES CONGENER Hagen.

This is common around the sloughs near Toppenish and Donald, but is most abundant on Satus Creek. It also occurs around Nigger Pond. It is an all-summer species, but is most abundant on Satus Creek during August and September.

Nymph (figs. 168–172).—This is described from a single nymphal skin found among *Juncus* stems on the banks of a stagnant pool of Satus Creek, September 3, 1914. *Lestes congener* was abundant at this point and was the only species of *Lestes* found on Satus Creek, though during the summer I made eleven trips at intervals of a week. A pair of *congener* were seen ovipositing a short distance from this point. The male was holding the female and she had her abdomen looped up as does the female of *Archilestes* and was placing eggs in a small willow stem about 2 inches above the surface of the water. In view of the abundance of *congener*, the lack of other species on the creek, and the careful collecting done, together with the small size of *congener*, with which the single skin agrees, I feel sure that this is the nymphal skin of *congener*.

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[1] Needham, James G., Macgillivray, Alex. D., Johannsen, O. A., and Davis, K. C. Aquatic Insects in New York State. Bull. 68, N. Y. State Mus., pp. 517, pls. 52, text figs. 26, 1903. See pp. 222, 223–224.

Length (head, thorax, and abdomen), 17 mm.; gills, 7 extra; abdomen, 12; hind femur, 4.5.

The nymph (figs. 168 and 169) is long and slender, but not so slender as the nymphs of *rectangularis* and others of the larger species of *Lestes*.

Head two and one-half times as wide as long (this measurement may be at fault because of the distortion of the skin). Eyes occupying only half of total width of head. Notch at back of head wide and shallow. Antennae (see fig. 171) with segments 1 and 2 heavy, the second longer than the first, the third to the seventh slender. The segments increase in length to the third and decrease to the seventh, which is minute. Labium (fig. 170) slender, but the base of the mentum not so slender as in *L. rectangularis*. Closed median cleft of median lobe extending below bases of lateral lobes. Mental setae long, a row of seven on either side. A seta on base of each lateral lobe and *four large setae* on each movable hook. Each lateral lobe bears three large hooks, the inner of which is the largest and having on its inner edge a row of minute teeth; the outer hook is second in size. Next the outer side of the middle tooth is a cutting edge of six or seven minute teeth.

Prothorax conic, with the dorsal scutum rectangular. Legs with faint band on distal end of femur.

Abdomen cylindric. Lateral keels of segments 5–9 terminating caudad in a sharp point. (See fig. 172.) Abdomen with lateral white stripe above each lateral carina and a middorsal white stripe. The dorsum of each abdominal segment with four black spots on its distal margin, one above posterior end of each lateral keel, and one on either side of the middorsal white spot. Gills (see fig. 168) oblong-lanceolate, with two dark spots on each edge.

4. LESTES DISJUNCTUS Selys.

I find several specimens of this from a slough near Toppenish.

5. LESTES UNCATUS Kirby.

Common about the various ponds. The specimens are not so brilliant as those from Bend, Oregon.

6. LESTES UNGUICULATUS Hagen.

Found occasionally about alkaline ponds.

7. ARGIA EMMA Kennedy.

Common along the streams from the last week in June until September. It is most abundant on Satus Creek south of Alfalfa.

(The Stanford collection contains a specimen from Prescott, Washington.)[1]

8. **ARGIA VIVIDA** Hagen.

I have taken this only on Satus Creek. A few specimens were taken south of Alfalfa, but it was much more abundant on Logie Creek, an upper tributary of Satus. It was emerging June 15. Old specimens were taken August 24.

9. **ENALLAGMA CALVERTI** Morse.

Common about alkaline ponds from May to July, when it is displaced by *carunculatum*.

10. **ENALLAGMA CARUNCULATUM** Morse.

This species appears about the alkaline ponds in June and by August is the most abundant species.

11. **ENALLAGMA CLAUSUM** Morse.

I took 2 males on Nigger Pond July 21, 1912.

12. **ENALLAGMA CYATHIGERUM** (Charpentier).

This species is common on the river and running creeks from May to September. It is most abundant in June.

13. **AMPHIAGRION SAUCIUM** (Burmeister).

Nowhere abundant, but occasional about the various ponds.

14. **ISCHNURA CERVULA** Selys.

Found about all the ponds. It reaches its greatest abundance in June, but is the earliest spring species and lasts till frost.

15. **ISCHNURA PERPARVA** Selys.

Found throughout the season, perhaps more abundant about the fresher ponds.

16. **OPHIOGOMPHUS OCCIDENTIS** Hagen.

I have a male and a female taken on Satus Creek south of Alfalfa. The female was caught resting on a willow in copulation with a male *severus*, which was abundant here. The identity of this and the next species I shall discuss in a forthcoming paper based on material collected by me in California.

17. **OPHIOGOMPHUS SEVERUS** Hagen.

Abundant on Satus Creek south of Alfalfa. Here the emergence commenced the second week in June and lasted until the first week in July. It occurred from 9 o'clock in the morning until 4 o'clock in the afternoon, the nymph seldom crawling more than 6 inches from the water. Oviposition was most common on about August 1 and the last specimens were seen August 24. Oviposition occurred almost altogether on the riffles, but emergence was almost altogether along the deeper mud-bottomed pools. In copulation the male sought the female while she rested on a stone. Copulation occurred immediately after the male grasped the female, and after a short flight to a near-by bush the couple would rest in copulation for many minutes. The male did not accompany the female during oviposition. The latter would rest on a stone in a riffle and every few seconds make a short flight, striking the tip of her abdomen on the surface of the water just once, when she would rest for a few seconds on a stone and repeat the process. These short flights were repeated five or six times in succession. By August 1 many individuals showed age in the frayed wings, the olive coloration, and in their difficulty in standing. Frequently when one would attempt to alight on a stone it would fall over on its side or tumble on its head. During the first part of their season they were most abundant on the gravel bars, but during the oviposition period they were most abundant about the riffles.

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[1] I found this species abundant in California on the Sacramento River at Colusa, on the Feather River at Oroville, and on the Chico River at Chico. The species was emerging June 10 at Colusa and was ovipositing on the Chico River June 17.

Figures 190 and 191 show dorsal and lateral views of the nymph of *severus*. Figures 192, 193, and 194 show details of the nymph of *severus* and figures 195, 196, and 197 details of that of *occidentis*.

18. GOMPHUS, SP.

I have several immature nymphs of *Gomphus* which I found in the Sunnyside Canal in 1912.

On November 1 of each year the headgates of the Sunnyside Canal are closed and remain closed until April 1 the following spring. On November 14, 1912, in the mud puddles in the bottom of the canal 36 miles below the headgates, I gathered 10 immature gomphine larvae. Four of these were undoubtedly *Ophiogomphus severus*, while the other 6 are undescribed nymphs belonging in the *Stylurus* subgenus of *Gomphus*. In going over the literature of gomphine nymphs I find that an attempt to assign these a specific identity would be largely a matter of shuffling the suppositions of the various students of Gomphus. I think that on two different occasions I have seen imago *Gomphus* on the Yakima River; if so, it is a species difficult to approach.

The six nymphs vary from 7.5 to 15 mm. in length. The abdomen of the longest specimen is 10 mm. long and 4 broad. Segment 9 about one and one-half times as long as 8. A longitudinal dorsal groove with a depressed triangular spine on middle of apical edge of segment 9. Segments 6–9 with lateral spines. Spines on segment 9 one-half as long as the cylindric segment 10. Labium one and one-fourth times as long as broad. Anterior edge of mentum almost a straight line, bearing 16–18 short, yellow, bristle-like scales. Lateral lobes with large hook curving in sharply at almost a right angle and bearing along its concave inner side 3 to 4 blunt teeth. Outer movable hook well developed. Antennae with third segment one and one-half times as long as first two and with fourth segment a short truncated cone curving upward so that the circular end surface is horizontal.

Figure 198 gives the dorsal view of the largest of these *Gomphus* nymphs and figures 199, 200, and 201 show details of structure of the same specimen.

19. ANAX JUNIUS (Drury).

Nigger Pond is the only place at which I saw this species. Here it emerged during July in great numbers, judging from the numerous exuviae clinging to the outer cattails, but during the many days spent in collecting on the pond I saw only an occasional *Anax*. I believe that the yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) which nested in the cattails ate most of the tenerals, as a single *Anax* reared by me emerged early in the morning when the blackbirds would be after such conspicuous morsels. I examined several blackbird stomachs with the following results:

CONTENTS OF STOMACHS OF SEVEN BLACKBIRDS.

(1) Stomach of male yellowhead: 13 teneral damselflies, 2 grains of wheat, and a mass of chitinous teneral remains.

(2) Stomach of male yellowhead: 8 wheat grains and a mass of teneral remains.

(3) Stomach of male yellowhead: 8 rye grains, 100 grass seeds (*Panicum* ?), 2 teneral Zygoptera, 1 wasp, and a mass of teneral remains.

(4) Stomach of female yellowhead: 2 beetles and a mass of teneral remains.

(5) Stomach of male red-winged blackbird: 1 beetle, 4 teneral damselflies, and a mass of teneral remains.

(6) Stomach of male redwing: A mass of wheat skins and 1 beetle, but no teneral remains.

(7) Stomach of female redwing: 1 beetle, 5 wasps, 4 caterpillars, but no teneral damselflies. This bird carried in its bill 1 moth, 1 fly, and 2 green caterpillars

Anax differs in time of emergence from the two species of *Aeshna* (*californica* and *multicolor*) which swarm about this pond. The *Aeshnas* emerge between 8 and 12 o'clock in the evening, consequently by daylight their wings are hardened and they are safe from blackbirds. So far as numbers of exuviae are concerned, *Anax* emerges in as great abundance as either *Aeshna*, but the adults of *Anax* are rare whereas adults of the species of *Aeshna* are abundant.

20. AESHNA CALIFORNICA Calvert.

This species appears some years as early as April 1. It is in its season during May and June and is seldom found during July or later. It swarms about those alkaline ponds in which there are few fish, but I have also taken it on the cold torrents (Logie and Dry Creeks) on the Yakima Reservation.

21. **AESHNA MULTICOLOR Hagen.**

This species is abundant about the alkaline ponds from June till August, with the height of the season during July. Both it and *californica* are wide fliers, being found at times several miles from the nearest water.

22. **AESHNA UMBROSA OCCIDENTALIS Walker.**

This species occurs with *palmata* on the streams of the valley, having about the same season and habits. It may emerge a week or two later, as I have tenerals from Satus Creek taken on August 17, when *palmata* was in fresh full colors. The teneral specimens of *umbrosa* are a rich deep chocolate including the upper half of the eyes, which shade into gray below. The tenerals hang on foliage frequently. The females of the species oviposit in the brush and bushes which lie partially submerged in the edges of the quiet side pools. The exuviae are found on the brush and tree roots about the deeper pools.

23. **AESHNA PALMATA Hagen.**

Occurs on streams from August until frost. Perhaps a week earlier than *umbrosa occidentalis* in emerging. As in eastern Oregon, it is about one-third as abundant as *umbrosa occidentalis* and has apparently identical habits.

24. **MACROMIA MAGNIFICA McLachlan.**

This species occurs on Satus Creek, south of Alfalfa. It occurs during July and August.

25. **CORDULIA SHURTLEFFI Scudder.**

I took one female on Satus Creek, south of Alfalfa.

26. **SOMATOCHLORA SEMICIRCULARIS (Selys).**

I have not taken this in the territory described at the beginning of this list, but found it common at Bumping Lake, one of the head waters of the Yakima River.[1]

27. **LIBELLULA FORENSIS Hagen.**

This is the most abundant *Libellula* about the ponds of the Yakima Valley. It occurs from June to August.

28. **LIBELLULA QUADRIMACULATA Linnaeus.**

The only place I have found this species is in a small pond east of Emerald station, not more than two dozen having been seen.

29. **LIBELLULA PULCHELLA Drury.**

This species was found occasionally about the sloughs in Parker Bottom near Donald.

30. **PLATHEMIS LYDIA (Drury).**

This was found occasionally about all the ponds from June to August.

31. **ERYTHEMIS SIMPLICICOLLIS (Say).**

This was found about all ponds from June to August.

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[1] Kennedy, Clarence Hamilton. Notes on the Odonata, or Dragonflies, of Bumping Lake, Washington. Proc. U. S. Nat. Mus., vol. 46, No. 2017, pp. 111-126, September 30, 1913.

32. SYMPETRUM CORRUPTUM (Hagen).

This species was the first *Sympetrum* on the wing, appearing the first week in June and lasting till frost. It was never abundant, seldom more than a half dozen specimens being seen on any single day, but it is met with on all ponds and streams.

33. SYMPETRUM COSTIFERUM (Hagen).

This is the most abundant *Sympetrum* about the alkaline ponds. I have seen thousands of this species on a telephone wire for a stretch of a mile and all facing the same way.

34. SYMPETRUM OBTRUSUM (Hagen).

I have only two male specimens of the white-faced form of this species. These were taken on Satus Creek.

35. SYMPETRUM OBTRUSUM (Hagen) var. DECISUM (Hagen).

This is abundant about the ponds, but more abundant in the upper valley than about Sunnyside.

36. SYMPETRUM PALLIPES (Hagen).

This beautiful species is never abundant anywhere, but it is found sparingly about the alkaline ponds as well as along Satus Creek.

37. SYMPETRUM MADIDUM (Hagen).

This species is peculiar in that the males and females are seldom found associated. The females only were found on Satus Creek south of Alfalfa Station. On Logie Creek, an upper tributary of Satus, both males and females were found as tenerals on June 15.

38. SYMPETRUM SEMICINCTUM (Say).

Common in the valley everywhere.

39. SYMPETRUM VICINUM (Hagen).

Found only on Satus Creek south of Alfalfa. Here it emerged during August.

40. LEUCORRHINIA INTACTA (Hagen).

One specimen was taken on a pond south of Sunnyside.

REPORT ON SOME CARBONIC ACID TESTS ON THE WEATHERING OF MARBLES AND LIMESTONES.

By George P. Merrill,

Head Curator, Department of Geology, United States National Museum.

The tests registered below were made with a view of determining not merely the relative solubility of certain calcareous rocks used for building and ornamental work, but as well, the manner in which the solvent acted. The ultimate aim of the experiments, as is obvious, was to ascertain how the stones would withstand the effects of an atmosphere and its rainfall made acid through absorbed carbonic acid. To make the results appreciable within a reasonable time, it was of course necessary to exaggerate the conditions. The process was as follows: Two samples of each stone selected were cut into the form of cubes approximately an inch in diameter, though without any attempt at exact correspondence in weight. How close the approximation is shown in the accompanying table of results.

The surfaces of each cube were rubbed with flour of emery on a glass plate as smooth as the nature of the material permitted, but no attempt was made to polish. They were then thoroughly washed and dried at 100° C. The cubes were then suspended by threads, in each case passed but once around the cube, in a large jar of water kept acid by a stream of carbonic acid from a charged cylinder. The water was changed once each week. No attempt was made to have the stream of bubbles constant and continuous, but the direction was changed occasionally to make certain that all were subjected to like conditions. Twice during the trial the cubes were withdrawn and while still suspended dried out by artificial heat and again immersed. At the end of 3 months they were all withdrawn, dried at a temperature of 100 degrees, and brushed off with a soft fitch brush to remove any loosened granules or dust. The appearance of each cube was carefully noted as to color changes as well as to the manner in which the solvent acted. The tables below give the weight of the cubes before and after and the loss of material both in weight and in percentage amounts. The first table gives the results of some preliminary tests which were not carried to completion, owing to imperfection of apparatus. They are, however, included here, since so far as they go they are confirmatory of those in the second. The results in both cases agree surprisingly well. It will be noted that while the amount of material lost in the first series is less than in the second, owing to the shorter period of trial, the two are always in accord. The amount of material lost by solution is not, however, the sole item of importance, nor indeed the item of most importance. It will be noted that in some instances a stone losing a certain amount still retains a nearly smooth surface and sharp arrises. Others become roughened, granules loosened to the point of falling away, and the arrises as a consequence left ragged. In some of the stones there is a tendency for the smaller interstitial crystals to disappear, leaving the larger standing in relief. The Tennessee samples tested are of the gray and pink spotted varieties. In these the tinted calcite, which, judged from the forms, represents fragmental fossil material, is more refractory than the colorless and is left in slight relief. In the case of the oolitic limestones the oolites are eaten out, leaving the crystalline or interstitial material and the fossil fragments in relief, the outline of the oolite being sometimes preserved by the insoluble impurities. The considerable amount of insoluble material set free from these oolitic cubes during the trial settling to the bottom of the jar as mud or remaining to be brushed off the surface when the cube was dried seems to have come wholly from the oolites, and not from the interstices. It will be noted, as might have been expected, that the dolomitic marbles were not appreciably affected and that the oolitic stones lost during the trial an amount two and three times as great as that of any other of the stones tested. In but one instance was there any marked change in color in any of the samples.

TABLE I.

PRELIMINARY TRIAL EXTENDING OVER PERIOD OF 70 DAYS.

Kind and locality.	Weight before trial in grams.	Weight after trial in grams.	Loss of weight in grams.	Percentage loss of weight.	Remarks.
White crystalline limestone: Marble, Yule, Colorado.	45.053 44.313	44.7075 43.8815	0.3455 0.4325	0.0077 .0097	Very slightly roughened; no granulation.
White crystalline limestone: Marble, Pickens County, Georgia.	42.3935 42.747	41.935 42.3565	0.4585 0.3905	.011 .009	Slightly roughened; no granulation.
White crystalline limestone: Marble, West Grove, Pennsylvania.	46.3455 44.7015	46.2345 44.586	0.1110 0.1155	.0024 .0026	Effect scarcely appreciable.
Pink crystalline limestone: Marble, Knoxville, Tennessee.	50.4485 48.478	49.904 47.9725	0.5445 0.5055	.0108 .0104	White portions slightly etched, leaving the pink standing in relief.
Gray crystalline limestone: Marble, Concord, Tennessee.	45.1075	44.4765	0.6310	.012	White portions slightly etched, leaving the pink standing in relief.
White crystalline limestone: Marble, Rutland, Vermont.	40.6655 41.1245	40.1185 40.432	0.547 0.6925	.013 .016	Surfaces appreciably roughened.
Blue crystalline limestone: Marble, Rutland, Vermont.	44.444 41.0555	43.8355 40.589	0.6085 0.4665	.015 .011	Surfaces appreciably roughened; no granulation.
White crystalline limestone: Marble, Carrara, Italy.	38.6165 40.5885	38.114 40.0925	0.5025 0.496	.013 .012	Surfaces appreciably roughened; like white Rutland.
White crystalline dolomite: Marble, Cockeysville, Maryland	38.80 36.507	38.7755 36.4855	0.029 0.0215	.00062 .00058	Not appreciably acted upon.
White crystalline dolomite: Marble, Tuckahoe, New York.	42.0655 41.405	42.0415 41.3795	0.0240 0.0255	.00056 .0006	Not appreciably acted upon.
Oolitic limestone, Bedford, Indiana.	43.5785 41.1475	42.2435 39.8795	1.335 1.268	.0304 .0308	Distinctly roughened and pitted, the fossil fragments left standing in relief.
Oolitic limestone: Bowling Green, Kentucky.	41.1655 37.8355	40.504 37.1725	0.6115 0.663	.014 .017	Distinctly roughened and pitted, the oolites being eaten out, leaving surface covered by circular and oval pits often with a slight residual eminence in center.

TABLE II.

SECOND TRIAL EXTENDING OVER PERIOD OF THREE MONTHS.

Kind of stone and locality.	Original weight in grams.	Final weight in grams.	Loss of weight in grams.	Percentage loss in weight.	Remarks.
White crystalline limestone: Marble, Yule Creek, Colorado.	51.551 48.194	50.6465 47.2465	0.9045 0.9475	0.017 .019	A very slight roughening of the surface, but no granulation and but slightly attacked on the edges or arrises.
White crystalline limestone: Marble, Pickens County, Georgia.	44.034 43.6675	43.315 42.946	0.719 0.7215	.0165 .017	Surfaces very slightly roughened, but no granulation.
White crystalline limestone: Marble, Cherokee County, Georgia.	43.3885 44.400	42.7335 43.683	0.655 0.717	.015 .016	Surfaces very slightly roughened, a slight yellowing.
White crystalline limestone: Marble, West Grove, Pennsylvania.	47.8385 47.9695	47.615 47.768	0.2235 0.2015	.0047 .0042	Surfaces roughened, but no granulation.
White crystalline limestone: Marble, Proctor, Vermont.	44.4945 44.1085	43.62 43.3125	0.8745 0.796	.019 .018	Surfaces distinctly roughened and granulated, small particles loosened and falling away when handled or brushed; arrises roughened.
White crystalline limestone: Marble, Proctor, Vermont.	44.974 45.172	43.9295 44.001	1.0445 1.171	.023 .026	
White crystalline limestone: Marble, Pittsfield, Vermont.	42.536 43.97	41.705 42.9715	0.831 0.9985	.019 .022	
White crystalline limestone: Marble, Carrara, Italy.	43.5085 42.462	42.598 41.4885	0.9105 0.9735	.021 .023	Surfaces distinctly roughened and granulated, small particles loosened and breaking away when handled or brushed; arrises strongly attacked.
Gray crystalline limestone: Marble, Knoxville, Tennessee.	46.796 45.1725	45.8765 44.2975	0.9245 0.875	.019 .019	Surfaces roughened by the corrosion of the colorless granules leaving the pink tinted standing in relief. No granulation or mechanical loosening of particles.
Gray crystalline limestone: Marble, Knoxville, Tennessee.	44.069 44.3095	43.226 43.4545	0.843 0.855	.019 .019	
Gray crystalline limestone: Marble, Knoxville, Tennessee.	45.7165 45.5565	44.52 44.609	1.1965 0.9475	.026 .021	
Pink crystalline limestone: Marble, Concord, Tennessee.	42.7345 42.9635	41.808 42.1675	0.9265 0.796	.021 .0185	
White crystalline dolomite: Marble, Cockeysville, Maryland.	40.724 38.4355	40.687 38.3995	0.037 0.036	.00091 .00093	No perceptible change.
White crystalline dolomite: Marble, Berkshire, Massachusetts.	45.529 45.052	44.8385 44.378	0.6905 0.674	.015 .015	Surfaces distinctly roughened by corrosion along planes of cleavage and color changed to a decided buff.
White crystalline dolomite: Marble, Lee, Massachusetts.	43.659 44.493	43.625 44.4415	0.034 0.0525	.00077 .0011	No perceptible change.
White crystalline dolomite: Marble, Tuckahoe, New York.	43.442 44.792 46.438 47.053	43.4025 44.7465 46.3815 47.0105	0.0395 0.0455 0.0575 0.0425	.00091 .0010 .0012 .0009	No perceptible change.
Oolitic limestone, Bedford, Indiana.	36.0945 38.3245	34.493 36.4495	1.6015 1.875	.044 .049	Surfaces much roughened and pitted owing to solution of the oolites leaving the fossil fragments and crystalline material of the interstices in relief; arrises strongly attacked.
Oolitic limestone, Bowling Green, Indiana.	38.4375 38.6845	37.1775 37.44	1.26 1.2445	.033 .032	The same, only that the stone is more distinctly oolitic and the surface becomes covered with circular and oval pits.
Oolitic limestone, Salem, Indiana	37.2795 37.45	35.39 35.591	1.8895 1.869	.0506 .050	

A COLLECTION OF AMPHIBIANS AND REPTILES FROM GOGEBIC COUNTY, MICHIGAN.

By ARTHUR T. EVANS,

Of the University of Colorado, Boulder.

Records from Gogebic County are included in but few of the reports on the herpetology of northern Michigan and in all these reports refer to a single species, *Thamnophis sirtalis* (Linnaeus).[1] Gogebic County is situated at the extreme western end of the Upper Peninsula of Michigan. The county lies approximately between the forty-first and forty-second degrees north latitude and between the eighty-eighth and ninetieth degrees west longitude. The topography of the county is more or less broken, there being many rocky hills. Much of the higher ground is covered by heavy hardwood forests some of which, however, have been cut over. In contrast to these habitats there are many dense arbor-vitæ swamps and occasionally small tracts of cleared farm land. In many places forest fires have laid waste large areas. Rivers, lakes, and large ponds are numerous. The climatic conditions of the county undoubtedly have a very decided effect upon the fauna. The winters are long and severe, usually lasting from October until May, during which time from one to several feet of snow fall and the temperature often reaches forty degrees below zero Fahrenheit. In 1913 the first snow of six inches fell on September 21. In the spring the snow does not disappear usually until the latter part of April, and during the spring of 1914 about three inches of snow fell on May 12. With the coming of warm weather lowlands for some distance on either side of the streams are overflowed. This condition continues for some time after all of the snow has disappeared from the woods. Summer weather does not usually begin before May. The summers are usually short and the temperature rarely exceeds ninety degrees Fahrenheit. The evenings are cool and frost may be expected any time after the first of August.

During the years of 1913 and 1914 while the writer was a resident of the county an effort was made to collect representatives of all of the species of amphibians and reptiles found there. The species taken are listed below. The collections were made in the vicinity of Wakefield, which is centrally located in the county. In all eleven species were taken, ten of these being recorded from Gogebic County for the first time and one being an addition to the fauna of the Northern Peninsula of Michigan.

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[1] Ruthven, A. G., Herpetology of Michigan, Mich. Geol. and Biol. Surv., 1912; and Ruthven, A. G. Bull. 61, U. S. National Museum, 1908.

AMPHIBIA.

CAUDATA.

1. PLETHODON ERYTHRONOTUS (Green).

The red-backed salamanders were found to be common in decayed tree trunks in the woods. Their preference seemed to be for pine logs, although they were found in the decayed trunks of other trees as well as under stones and rubbish. One individual was taken with a partly regenerated tail.

12 specimens, 56–98 mm., September 26, 1913, U.S.N.M., No. 51943–51954.

2. AMBYSTOMA JEFFERSONIANUM (Green).

Common in the lowlands near small streams, under logs.

6 specimens, 54–65 mm., September 26, 1913, Nos. 51937–51942.

SALIENTIA.

3. HYLA PICKERINGII Holbrook.

Although the species is common in the region, judging from the numbers of individuals seen and the calls heard, specimens were difficult to obtain. Several specimens were taken in swampy places near Sunday Lake.

1 specimen, 17 mm., September 6, 1913, No. 51923.

2 specimens, 26 and 28 mm., May 9, 1914, Nos. 51924–51925.

4. HYLA VERSICOLOR LeConte.

A specimen of this species was captured on June 6, 1914, but escaped before it could be preserved.

5. RANA PIPIENS Schreber.

This species was found to be very abundant about ditches and in swampy places. It is the first of the amphibians to appear in the spring, specimens being taken about the middle of April. Eggs of this species were found on April 19, 1914, and small tadpoles of this species were seen the latter part of the month.

4 specimens, 40–85 mm., September 6, 1913, Nos. 51927–51930.

6. RANA CLAMITANS Latreille.

This species was rather uncommon, although not rare. Several specimens were taken from an old open well in a swamp in the fall, while others were captured in the spring.

4 specimens, 40–55 mm., September 6, 1913, Nos. 51933–51936.

7. RANA CANTABRIGENSIS Baird.

This species is common in pools adjoining wooded areas. They were also seen in large numbers along the railroad right of way in the springtime. The adults of this species are easily distinguished while floating at full length upon the surface of the water.

8. RANA CATESBEIANA Shaw.

Specimens of the bullfrog were taken in company with *Rana clamitans* from an old open well in a swamp. The characteristic call of this species was heard during the spring of 1913. From the few specimens taken and the absence of previous records from the Northern Peninsula the bullfrog is probably a rare species in Gogebic County.

2 specimens, 70 and 100 mm., September 6, 1913, Nos. 51931–51932.

9. BUFO AMERICANUS Le Conte.

This toad is common in Gogebic County, and many specimens were seen along the roads and in gardens from April to October.

1 specimen, 70 mm., September 2, 1913, No. 51926.

REPTILIA.

SERPENTES.

10. THAMNOPHIS SIRTALIS (Linnaeus).

This garter snake is very common in semiaquatic habitats, and several specimens were captured. Individuals of this species were seen in the spring of 1914 as early as May 20.

3 specimens, September, 1913, Nos. 51918–51920.

11. STORERIA OCCIPITOMACULATA (Storer).

The red-bellied snake was found a common species in Gogebic County. Of three specimens taken, one was captured under a log and the others were taken in the open field.

1 specimen, 270 mm., September 27, 1913, No. 51922.

1 specimen, 230 mm., May 9, 1914, No. 51921.

TESTUDINATA.

12. CHRYSEMYS BELLII (Gray).

Descriptions were given the writer of turtles from ponds near Wakefield, which make the presence of painted turtles in Gogebic County certain. Since *C. bellii* is very closely related to *C. cinerea* (Bonnaterre), a species common in the Southern Peninsula, the species found in Gogebic County was not determined. It is listed here as *C. bellii* since that species has been recorded from the adjoining county on the north, Ontonogan, by Ruthven.[1]

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[1] Ruthven, A. G., Herpetology of Michigan, Mich. Geol. and Biol. Surv., p. 144, 1912.

Eighteen species of amphibians and twenty-six of reptiles are recorded from the entire State of Michigan.[1] Of this number 13 of the amphibians and 6 of the reptiles have been found in the Northern Peninsula of Michigan, and one species of amphibian, *Rana catesbeiana,* is added to the fauna of the Northern Peninsula by the present collection. The four species of amphibians found in the Southern Peninsula thus far not reported from the Northern Peninsula are *Ambystoma tigrinum* Green, *Necturus maculosus* Rafinesque, *Ambystoma maculatum* (Shaw), and *Acris gryllus* LeConte. The reptiles are represented by fewer species in the Northern Peninsula than in the Southern, but five of the twenty-six species reported from the entire State having been recorded from the Northern. The relation of the amphibian and reptile fauna of Gogebic County to that of the entire Northern Peninsula may be seen in the following table.

Species of amphibians and reptiles known from the Northern Peninsula of Michigan.

Necturus maculosus Rafinesque.
Ambystoma jeffersonianum (Green).[2]
Hemidactylium scutatum (Schlegel).
Plethodon erythronotus (Green).[2]
Diemictylus viridescens Rafinesque.
Bufo americanus LeConte.[2]
Hyla pickeringii Holbrook.[2]
Hyla versicolor LeConte.[2]
Rana pipiens Schreber.[2]
Rana clamitans Latreille.[2]
Rana cantabrigensis Baird.[2]
Rana catesbeiana Shaw.[2]
Rana septentrionalis Baird.
Chorophilus nigritum LeConte.
Storeria occipitomaculata (Storer).
Liopeltis vernalis (DeKay).
Thamnophis sirtalis (Linnaeus).[2]
Chelydra serpentina (Linnaeus).
? *Chrysemys bellii* (Gray)[2]

The writer wishes to thank Dr. Max M. Ellis for aid in the preparation of the account.

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[1] Ruthven, A. G., Herpetology of Michigan, Mich. Geol. and Biol. Surv., 1912.

[2] Recorded from Gogebic County.

A NEW RESTORATION OF STEGOSAURUS.

By Charles W. Gilmore,

Assistant Curator of Fossil Reptiles, United States National Museum.

In a recent paper[1] I have reproduced ten restorations of *Stegosaurus* as depicted by various authorities between the years 1891 and 1912. These show a considerable variety of interpretations, and are of interest as exhibiting the diverse opinions held regarding its probable appearance in the flesh, and especially as to the arrangement of the dermal armor, which forms such a conspicuous feature of the external anatomy of this curious reptile. Since none of these restorations portray fully the ideas set forth in the bulletin cited above, I have recently prepared a small model of *Stegosaurus* one-twelfth linear dimensions, the proportions of the model being based upon careful measurements made from the type-specimen of *Stegosaurus stenops* Marsh now in the United States National Museum. In this model I have incorporated all of the evidence relating to its external appearance accumulated during several years' study of a large series of Stegosaurian remains, and I believe that the more important facts relating to the proper arrangement of the dermal armor has now been quite fully established.

Briefly, these facts are: That the dermal plates of opposite rows alternate, not paired; that the largest plate of the series, as shown by two individuals found in place, is above the base of the tail, not over the pelvis; that there are not more than 18[2] in the complete series of flat plates; that the dermal spines number four, based upon the evidence of association in six individuals; that the bases of the plates of opposite rows are comparatively close together on either side of the median line of the back; that although the evidence is not conclusive, there is every probability that the so-called gular ossicles covered the top and sides of the head and neck, as indicated in the model, rather than the throat, as represented in previous restorations. In fig. 1 is shown a drawing of the plates in alternating position, probably made under the supervision of Dr. F. A. Lucas at the time he

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[1] Charles W. Gilmore, Bulletin 89, U. S. National Museum, December 31, 1914, pp. 122-126, pls. 32-36.

[2] In Bulletin 89, U. S. National Museum, it was stated "there are not more than 22 and perhaps only 20," but after preparing this model to scale I am now convinced that my first estimate was too large.

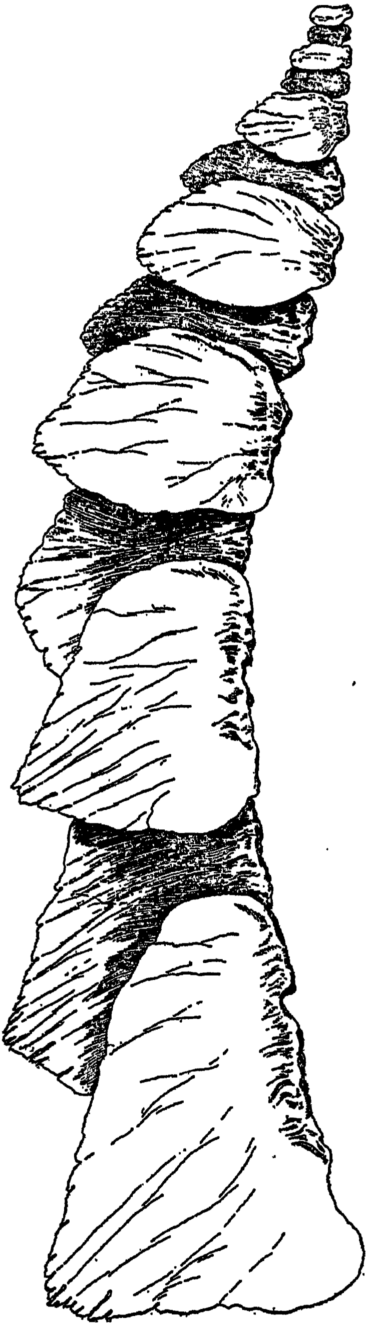


FIG. 1.—DERMAL PLATES OF STEGOSAURUS STENOPS MARSH. TYPE. No. 4934 U. S. NATIONAL MUSEUM. ABOUT $\frac{1}{11}$ NATURAL SIZE. THE FIRST PLATE NEAREST THE HEAD IS MISSING.

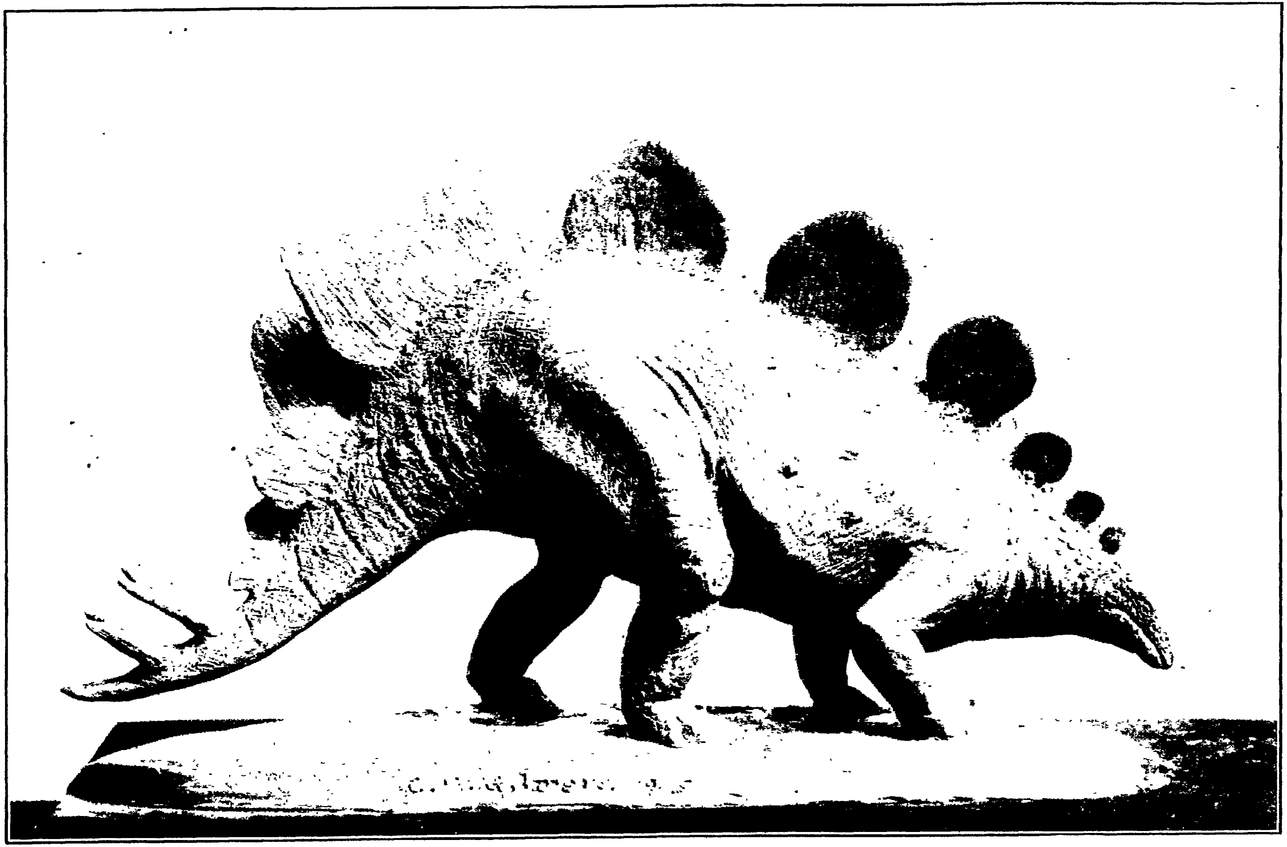
was studying the Stegosaurs. It came into my hands for the first time a few days after the model was finished, and it was particularly gratifying to find that independent work should bring such close agreement in the final results. It also explains one of the difficulties encountered in making some of the earlier restorations where the body is obviously too long. This was brought about, apparently, by placing the largest plate of the series above the pelvis, which necessitated lengthening the body in order to have space for the plates which have been found in place in advance of it. In the model the presacral region is relatively shorter than has been represented in earlier restorations, but since it is based upon careful measurements made from the entire presacral series, it will be seen there is good reason for this shortening, and it is therefore in perfect accord with the evidence for the present position of the dermal armor. The angulation of the occipital condyle in relation to the longer axis of the skull in *Stegosaurus* is such as to cause the nose of the skull to be depressed if the articulated condyle is to be in line with the cervical vertebræ. While this pose allows of further depression and also of elevation of the nose, it would appear to be the more characteristic position, as shown in the model.

At this time the character of the skin covering of *Stegosaurus* is wholly conjectural, but from what is now known of the integumentary covering of some members of the Ceratopsian and Trachodont dinosaurs it is not unreasonable to expect that of *Stegosaurus* to be scale-like, with numerous bony skin ossicles scattered over the sides of the body, as indicated in the model. In the light of recent discoveries, we may yet hope to have definite knowledge as to its true nature.

The head and neck, the massive fore and hind limbs, and in fact the whole appearance of the animal indicate slow locomotion on all four feet. The exceedingly small and feeble teeth would appear to indicate that *Stegosaurus* must have fed upon the most succulent of terrestrial plants. The feet are large, as though to support the creature's weight on yielding soil. Their structure implies that they were land-haunting, doubtless of low, swampy regions rather than the upland, but they also suggest being adaptations from a group highly specialized for locomotion upon land, and there is every reason to believe that *Stegosaurus* was descended from a bipedal ancestry. Increasing bulk and development of the armor caused them to lose celerity of movement, and they became sluggish, slow-moving creatures, of low mentality, only sufficient, perhaps, to direct the mere mechanical functions of life.

EXPLANATION OF PLATE 52.

Model of *Stegosaurus stenops* Marsh based upon the type skeleton, Cat. No. 4934 U. S. National Museum. Right side. About $\frac{1}{27}$ nat. size. Modeled by Charles W. Gilmore.



MODEL OF STEGOSAURUS STENOPS MARSH BY C. W. GILMORE.

FOR EXPLANATION OF PLATE SEE PAGE 357.

A COLORED DRAWING OF THE MEDEBA MOSAIC MAP OF PALESTINE IN THE UNITED STATES NATIONAL MUSEUM.

By I. M. Casanowicz,

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INTRODUCTION.

A colored drawing of the Medeba mosaic map of Palestine was acquired by Mr. S. W. Woodward, of Washington City, from a book dealer in Jerusalem, while on a tour around the world in 1899 in the interest of Christian missions, and by him presented to the United States National Museum. A comparison of the drawing with other reproductions of the original, which have been prepared by competent archeologists and Biblical scholars, shows that, with the exception of a few omissions and transpositions, it affords a fairly adequate view of the original. It has therefore been deemed worth while to describe this highly interesting and important monument for the readers of the publications of the United States National Museum, the more so as a comprehensive and detailed discussion of the subject has hitherto not been published in the English language.

LITERATURE CONSULTED.

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THE TOWN OF MEDEBA.

Medeba[1] was originally a town of Moab situated almost directly east of Bethlehem, about five miles south by west from Hebron, at an elevation of 2,040 feet above the sea level. It is frequently mentioned in the Old Testament and played a considerable part in the frontier conflicts of the Israelites, being often taken and retaken. From the Moabites it was wrested by the Amorites (Numbers xxi, 30). After the conquest of Canaan it was allotted to the tribe of Reuben (Joshua xiii, 9, 16). In David's time it was an Ammonite point of defence (I Chronicles xix, 7). In the 9th century B. C. it was seized by Omri, King of Israel, and recaptured by the Moabites.[2] During the Maccabean period it was the seat of a robber clan who murdered John, the brother of Jonathan, the Jewish prince (I Maccabees ix, 35–37). It was taken by John Hyrcan (135–105 B. C.) and had to be retaken by Alexander Jannaeus (104–79 B. C., Josephus, Antiquities, XIII, 1, 2, 4; XV, 4).

Under the Romans Medeba was incorporated in the province of Arabia, which was established by Trajan (98–117 A. D.), and from the reign of Elagabal (218–222 A. D.) there are extant coins bearing the name of Medeba. During the Byzantine period Medeba seems to have been a flourishing Christian center. It was the seat of a bishop who attended the council of Chalcedon (451 A. D.). It was probably overwhelmed and destroyed either by the Persians under Chosroes II, who at the beginning of the seventh century wrested the entire Christian Syria from the eastern empire, or by the Arabs under Omar, who in 636 completed the conquest of Syria and Palestine. Since then and until the latter part of the eighteenth century it lay in desolation and ruins and forgotten. In 1880 a Christian colony, mostly of Greeks, from Kerak (the Biblical Kir Moab, Isaiah XV, 1), and also some Latin (Roman Catholic) fathers settled there. In erecting the necessary buildings for the new occupation many ancient remains have been brought to light. These include a large pool with solid walls (324 by 309 feet and from 10 to 13 feet deep), ruins of several churches, remains of a colonnaded street, inscriptions, and mosaic pavements. The character of some of the ruins show that part of the town had pretensions to elegance. The most interesting and noteworthy discovery, both from an archeological and artistic standpoint, was that of the mosaic map of Palestine and of part of Egypt.

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[1] So in the English Bible, in Hebrew, Medeva; on the Moabite stone (9th century, B. C.), Medheba; Josephus, Antiquities, XIII, 9, 1, Medaba; Eusebius (OS, p. 128), Medaba and Medabba; Ptolemy, Geography (2nd century A. D.) IV, 17, 6, Medana; the modern Arabic name is Madeba.

[2] Compare Moabite stone (a plaster cast facsimile of which is in the National Museum), line 8: "Omri had taken possession of the land of Medeba and (his people) occupied it during his days and half the days of his son, forty years, but Chemosh restored it in my days"; compare also Isaiah XV, 2).

DISCOVERY AND CONDITION OF THE MOSAIC MAP.

The first notice of the map came through a monk belonging to the Christian colony settled at Medeba, the find having been uncovered in cleaning the ground for a new church on the lines of an old one. In 1882 this monk wrote concerning the mosaic to Nicodemus the Greek Patriarch of Jerusalem, who simply laid the letter aside without paying any attention to the subject. His successor, the Patriarch Gerasimus, found the letter and sent a master mason (with the pretentious title of architect) to examine the mosaic with directions to include it in the new church if found worth while. The "architect" did not find it worth while. And thus in the building of the new church large portions of the mosaic were destroyed. A pillar of the new church was driven through the midst of the mosaic (seen on the plate in rectangular blank at the southern extremity of the Dead Sea). Large parts were covered by cement for the flooring of the new church. In this condition Father Cleopas Koikylides, librarian of the Patriarch of Jerusalem, found the mosaic in 1896 and took steps for its preservation by imbedding the fragments in the floor of the new church. To judge from the remains, the map had previously undergone several restorations. For in several portions a plain mosaic or merely cement fills out destroyed parts. Though rather a primitive and crude way of repairing works of art, it substantially contributed to the preservation of the monument by preventing further crumbling of the remaining parts.

THE BOUNDARIES OF THE MAP.

The following is suggested as mere conjecture. The longest connected fragment reaches an extension of about 35 feet from the spring of Aenon near Salim in the north to the delta of the Nile in the south, while the church of which the mosaic formed the pavement is about 55 feet wide. There would thus remain a lacuna of about 20 feet.[1]

It may perhaps be assumed that the region of the Nile Delta, which alone is related to the Biblical narrative because the Israelites sojourned there before they set out to Canaan, represents the original southern limit of the map. The north side may have reached to the northern confines of Phenicia. It may be assumed that the scale was contracted northward, as that region gave the artist less occasion and opportunity for illustration and comment. On the east side the map may have been bounded by the River Euphrates, which in Biblical tradition is the ideal boundary of Israelite power and expansion (compare Genesis xv, 18; Deuteronomy i, 7; xi, 24; Joshua i, 4, etc.), while on the west side the Mediterranean Sea would be the obvious boundary. Little weight is to be attributed to the assertion of some inhabitants of Medeba that they read the names of Ephesus and Smyrna on the map years ago, so that it contained also Asia Minor (Biblical World, 1898, p. 254).

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[1] So Kubitschek (p. 348), who gives the dimensions, respectively, "over 10.5 meters," "17 meters," and "6.5 meters;" Beazley (p. 517), assumes "that the original once occupied a space of about 49 by 20 feet" and that "what remains in all (is) about half of the complete scheme," while Father Cleopas is quoted in the Biblical World for 1898 (p. 254), calculating that "the fragments remaining contain about 18 square meters, and the map originally covered 280 square meters."

GENERAL FEATURES OF THE MOSAIC MAP.

The Medeba map is not only the earliest map of Palestine preserved, but also the oldest detailed land map that we possess. It originated in the Greek part of the world, while all other itineraria and maps of Palestine belong to the Latin West and are inscribed in Latin.

Like all the maps which are based on Greco-Roman tradition, the map of Medeba is orientated toward sunrise; that is, the east is placed at the top, the west at the foot, the north at the left, and the south at the right. This orientation "may be designated as the ecclesiastical, as without doubt the east was the determinating point of the compass for the medieval geography for the reason that Paradise was there located" (Schulten, p. 112). As the church of Medeba is, according to ancient usage, likewise orientated toward the east, the visitor on entering the church looked in the same direction toward the apse and altar of the church, and at the same time in the eastern direction of the sky, and thus a natural connection between the picture of the map and the reality was established. In agreement with this orientation the explanatory inscriptions are placed on the west line and were to be read from the door side of the church. In like manner the pictorial representations of cities, buildings, mountains, trees, etc., are placed on the basis of the west as the foot line.

It is evident that the artist attempted to combine a view of ancient Canaan with a picture of Palestine of his time. As ancient historians often projected their time into the past, so the maker of the map had before his mental eye the land of the patriarchs not separated from the contemporaneous Palestine. Past and present were blended into one picture. That the artist had Biblical Palestine in mind is shown by the prominence given to the tribes of Israel on the map. The names of the tribes are inscribed on the map in particularly large red letters, are in most cases accompanied by a Biblical reference, chiefly taken from the so-called blessing of Jacob (Genesis, chapter xlix) and blessing of Moses (Deuteronomy, chapter xxxiii) and quoted after the Greek translation of the Septuagint. Out of the twelve tribes of Israel only six are preserved entire or fragmentary, namely, Dan, Simeon, Judah, Ephraim, Benjamin, and Zebulon. In connection with Dan the apostrophe from the Song of Deborah (Judges v, 17) is quoted, "Why did he remain in ships?" The legend with the name of Simeon is now wanting; Ephraim is associated with the blessing of Jacob upon Joseph; "God blessed thee with the blessing of the earth having everything" (instead of "will bless thee with the blessings of heaven" of the received text, Genesis xlix, 25), and "Blessed of the Lord be his land" (Deuteronomy xxxiii, 13); with Benjamin are the words, "The Lord shall cover him all the day long, and he shall dwell in his territory" (instead of "between his shoulders" of the received text, Deuteronomy xxxiii, 12); of Zebulon now only five letters remain, but the fragment containing the inscription bearing on Zebulon had already been discovered in 1890, without its connection being then recognized, and the inscription copied before it was destroyed. It read: "Zebulon shall dwell at the haven of the sea; and he shall be for an haven of ships; and his border shall be into Sidon" (Genesis xlix, 13).[1] By the side of this legend was the representation of a ship, "which some have tried to make out to be St. Peter's boat," the church being, according to them, dedicated to St. Peter. In this place it is clearly a mere symbolical indication of the sea.[2] It also appears that the artist wished to put on the map besides Palestine all the places which had been of importance to the Israelites before their entrance into Canaan—the region of Goshen in Egypt which held them in servitude; Raphidin, the desert of sin; and the mountain range of Sinai.

But it is the Palestine of the Byzantine period that is represented on the map. Alongside of the Biblical place names are often given those in use at the time of the composition. Of the about 140 place names preserved on the fragment, about 60 have no reference to the Biblical narrative. Of the latter many were episcopal sees, but a considerable number had no relation either to the Scriptures or the development of Christianity, as far as known, and there are also some otherwise unknown names of towns.

In its general purport the Medeba map is—like the mosaic pictures of sacred history—an illustration of the Bible rather than a work of geography. The artist was more intent on the picturesque details than on geography. Much care is bestowed on the pictures of towns. In those of large cities like Jerusalem, Gaza, etc., an attempt is made to give a view of the principal streets, marked by a colonnade, and to represent some of the prominent buildings. Small places are indicated by an outline of a wall, flanked by towers, reminding of the cities figured on Greek coins of the Roman period and on Roman medallions.

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[1] Published by Germer-Durand in Cosmos, new series, vol. 18, p. 286.

[2] Clermont-Ganneau, PEFQS, 1897, p. 215.

Prominent on the map is the water. The Jordan as a comparatively broad stream falls into the Dead Sea. The delta arms of the Nile represent broad stripes. The Dead Sea forms one of the great features of the mosaic. The green surface is agitated by waves or currents represented by thick black streaks. In the Jordan and the Nile (in the latter not seen on the reproduction) fishes disport themselves, while on the Dead Sea, in which fishes can not exist, life is represented by two vessels, one an oar boat with one sailor and two oars, the other and larger one, with a mast having a yard at the top and something like a snake, which is doubtless meant for a sail; besides two oars, and two visible sailors. Intercourse between the two sides of the Jordan is mediated by two bridges.

The mountains of Sinai and of Judah are depicted in various tints to indicate the different strata, and fairly produce the effect desired.

A tendency to the realistic genre appears in the desert scene of a gazelle being pursued by a lion or panther, in the fruit-laden palm trees, especially around Jerico, the "city of palms" (Deuteronomy xxxiv, 3; Judges i, 16; iii, 13; II Chronicles xxviii, 15), and Segor or Zoar.

On a freely conceived decorative illustration, which the mosaic is, in its general purpose, it is not to be expected to find the distances of the places from one another or their relative positions shown with mathematical accurracy. Thus Palestine, and especially Jerusalem, are enlarged out of proportion, in violation of the law of scale, while Egypt is squeezed in on a small space. Still the location of places is on the whole approximately accurate, and the general arrangement is displayed well enough, and the picturesque details show not only the hand of an artist, but also a careful study of the localities.

PLACEMENT OF THE MOSAIC MAP.

The idea of decorating the floor of a church with a map of Palestine in mosaic is certainly unique, and the question arises, What suggested it? Schulten's answer has at least the merit of attractiveness. His theory (p. 113 and following) is that the mosaic was intended to allow the pilgrims who after traversing the Holy Land came to the East-Jordan region (as shown by the Itineraria), where Medeba was situated, to repeat and recapitulate the real trip through the land once more in miniature on the map. Schulten suggests that the mosaic may be the votive offering of some wealthy pilgrim in gratitude for the happy accomplishment of his journey in the Holy Land, and that the dedication was lost along with the greater part of the map.

Clermont-Ganneau (PEFQS, 1901, p. 243 and following) makes the objection to this explanation that it "doesn't account for the fact that the pilgrim had chosen, among so many other basilicas where he might have had the work executed—to commence with Jerusalem—just the church of a remote town at the bottom of the land of Moab."

To this objection may be answered that Medeba seems to have been in the Byzantine period a center of the mosaic art or mosaic technique. Many beautiful mosaics which belonged to churches and monasteries of the fourth, fifth, and sixth centuries have been uncovered, and may still be seen in hovels, stables, and farmyards. Mosaics of much artistic taste are also found in private houses. According to eyewitnesses almost every house was adorned with this decoration. It has therefore been called "The City of Mosaics."[1] This would account for such an elaborate piece of work as the map is having been undertaken at Medeba. Clermont-Ganneau's own theory, advanced by him as "pure conjecture," is: "It is necessary to consider before all the position of Madeba. It is situated close to Mount Nebo. In its immediate neighborhood Moses received the order to climb the summit of Pisgah, where he was to die, and to contemplate in one supreme vision in all its extent the Land of Promise which was to belong to his people, but where he was not himself allowed to enter" (Deuteronomy xxxii, 48–52; xxxiv, 1–8; compare iii, 27; Numbers xxvii, 12).

"This geographical picture, which was virtually unrolled under the eyes of Moses, was intended to reproduce in the mosaic of the basilica of Madeba—that is, in the neighboring town to this memorable scene."

"One could thus explain why this map comprises not only the Promised Land, properly so called, but also lower Egypt; that is to say, the scene of the high deeds of Moses and the events preceding the Exodus which took place in this region."

DATE OF THE MAP.

The art style of the mosaic which indicates the transition from the antique tradition to the conventional schematism of the Byzantine period would comport with the sixth century A. D., more specifically with the age of Justinian (527–565 A. D.). With this date would also agree the neatness of the characters in the inscriptions, which are almost free from ligatures and abbreviations, which was later on in vogue, and the substantially correct orthography.

PLACES AND INSCRIPTIONS ON THE MAP.

The places are illustrated by some picture or vignette representing a town or building (some of which are wanting on the reproduction). In addition to the geographical names there are in some cases added, as has been stated above (p. 362 and following), biblical quotations or brief references to some historical events. The geographical names are regularly written above the places which they designate; the additional legends are placed below or beside the places to which they refer. The lettering is in black on light ground, in white on dark ground, and in red when the inscription is of special importance.

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[1] Lammens, Etudes publiées par des pères de la compagnie de Jésus, I, 73, 721, and I, 74, 44, quoted by Jacoby, Das geographische Mosaic von Madaba, p. 21; compare also PEFQS, 1895, p. 208.

It is generally agreed that the map is dependent on the Onomasticon of Eusebius. This is evidenced by the fact that the additional legends are literally, or almost so, taken over from the Onomasticon. Kubitschek (Die Mosaikkarte Palästinas, pp. 353, 358, etc.) and Clermont Ganneau (PEFQS, 1901, p. 236) are even inclined to the assumption that the topographical work of Eusebius had been provided with a map, and that this map was used by the mosaist of Medeba as a copy, or at least as a model.

In the following enumeration of the places preserved on the mosaic there will be first given a transcription of the names and translation of the additional legends as restored by the most competent authorities, followed in case of biblical localities, by the form of the names in the English Bible with the biblical references, and where it is of interest the version of the Onomasticon of Eusebius and St. Jerome will be quoted.

For the sake of a better survey the area of the map is divided into six zones or sections, beginning at the north:

1. FROM THE JORDAN TO THE SEA, NORTH OF THE SECOND BRIDGE OVER THE JORDAN.

Aenon, near Salem.—Eusebius (OS, p. 40) adds: "Here John baptized."—Aenon, near to Salim (John iii, 23), identified by some with modern Ainun (see PEFQS, 1881, p. 47).

Koreous (part of the representation of a building is wanting on the reproduction).—The Korea and Koreae of Josephus (Antiquities, XIV, 3, 4; War, I, 6, 5; IV, 8, 1), Modern Karawa.

Archelais.—Named after Archelaus, son of Herod, King of Judea, who built it (see Josephus, Antiquities, XVII, 13, 1; XVIII, 2, 2). It was later an episcopal see.

To the left of it is *Phasaelis* (restored), erected by Herod in memory of his brother of the same name (see Josephus, Antiquities, XVI, 5, 2; XVII, 8, 1; XVIII, 2, 2). Still preserved under the name of Ain el-Fasail.

Eastern frontier of Judea. *Akrabbim,* which now is called Akrabitte.—The mosaist has here apparently confused Akrabatta, the main place of the mountain district of Akrabattene (Josephus, War, II, 20, 4; IV, 9, 4; 9, 9), modern Akraba, which he rightly locates here in the north, with Akrabbim, in the extreme south of Judea (Numbers xxxiv, 4; Joshua xv, 3; Judges i, 36; see Josephus, Antiquities, XII, 8, 1).[1]

Neapolis—modern Nablus, and Sychem or Sikima in the region of Salem, which Jacob gave to Joseph, and Sychar, where is the well of Jacob.—These three places are usually identified with one another. The mosaist has correctly separated them. For Neapolis was not exactly situated on the site of Shechem, and Sychar is one mile east of Shechem.[2] For the expression, "Sychem in the region of Salem" see Genesis xxxiii, 18. There is at present east of Nablus a village called Salim (Jacoby, Das geographische Mosaic von Madaba, p. 81). Sychar and the well of Jacob are mentioned in John iv, 5, in the story of the conversation of Jesus with the Samaritan woman. There is still at present a place named Askar near Nablus which is usually identified with Sychar of the Gospel (Jacoby, p. 82, see also Clermont-Ganneau, PEFQS, 1901, p. 237).

To the right of Neapolis is the picture of a building with a round tower and over it the inscription *Sanctuary of the Holy Elisa.*—It represents the sancutary erected on the site of the spring whose bitter waters the prophet Elisha rendered sweet, as related in II Kings ii, 19–22. Underneath.

Tour Gobel and down to the left, *Tour Garizin*—The mountains Ebal and Gerizim from which the curses and blessings respectively were pronounced, while half of the tribes stood on one mount and half on the other (Deuteronomy xi, 29; xxvii, 13; Joshua viii, 33.) On the original, these mountains are also represented near Jericho under the names of Gebal and Garizeini. This double placing of the mountain pair is also found in Eusebius (OS, p. 64). There were two traditions as regards the site of the two mountains. The Samaritans and many Arabian geographers place them near Neapolis, while Eusebius, (OS) located them in the neighborhood of Jericho and Gilgal. The mosaic takes account of both traditions and apparently giving preference to the probably more correct one of the Samaritans.

Below is a remnant of the name of *Ephraim* and the blessing relating to Joseph and Ephraim which has been already quoted (p. 363).

On detached fragments, next to the margin, are the five letters of the legend connected with the tribe of *Zebulon* (Za. . .Kes) for which see above (p. 363), and *Agbar*—Lagrange would identify it with Akhabara mentioned in Josephus, War II, 20, 6 and Joseph, Life, 37, as a town in Upper Galilee, while Clermont-Ganneau (PEFOS, 1901, p. 240) sees in it the town of Gabarah or Gabaroth of Josephus, Life 10, 25, 45 and 47, considering the A as prosthetic.

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[1] Schulten, Die Mosaikkarte von Madaba, p. 8; compare E. Schuerer, Geschichte des juedischen Volkes im Zeitalter Jesu Christi, ed. 2, Leipzig, 1886, vol. 11, p. 138, n. 437.

[2] See George Adam Smith, The historical geography of the Holy Land, London, 1904, pp. 367–372; PEFQS, 1878, p. 114.

2. BETWEEN THE SECOND BRIDGE OF THE JORDAN AND JERUSALEM.

Galgala, which is also called the Twelve stones.—Gilgal, where the Israelites erected twelve stones in commemoration of their passage of the Jordan (Joshua iv, 20). Eusebins (OS, p. 66) adds: "And to the present day is shown a desert place two (Roman) miles from Jericho, which is held by the people in veneration." Modern Tel Jeljul.

Jericho.—Illustrated by extensive building and surrounding palm trees (Deuteronomy xxxiv, 3).

Louza, which is also called Bethel.—Genesis xxviii, 19; xxxvi, 6.—Modern Beitin.

Gophna.—Ophni, Joshua xviii, 24, see Josephus, War, 1, 11, 2; V, 2, 1, etc. It is identified with Jufna, a village situated between Jerusalem and Nablus.

Gabaon.—Gibeon, Joshua ix and x; later place of sanctuary, I Kings iii, 4; I Chronicles xvi, 39; Modern El-Jib.

Rama.—Several places in the mountain districts of Palestine bear the name of Ramah, which means "height." The present Ramah is mentioned together with Gibeon in Josuha xviii, 25, as being north of Jerusalem and belonging to the tribe of Benjamin. Near it lay the grave of Rachel, according to Jeremiah xxxi, 15, who represents this ancestor as appearing on her grave and uttering a lamentation for the exile of her children. In Matthew ii, 18, this passge is quoted in connection with the slaughtering of the children caused by Herod. The mosaist places another Ramah near Bethlehem and following Matthew erroneously quotes from Matthew and Jeremiah (as also Eusebius, OS, p. 148) the words: "A voice was heard in Ramah," but in this quotation doubtless the Ramah near Bethel is meant.—Identified with El-Ram, about five miles north from Jerusalem.

Remmon.—Several plans with the name Rimmon occur in the Old Testament; here is probably meant the Rimmon of Judges xx, 45.—Identified with modern Rammon, east from Bethel (on the drawing it is incorrectly placed northwest of Bethel).

Armathem or Arimathe.—Arimathaea, Matthew xxvii, 57; Mark xv, 43; Luke xxiii, 51; John xix, 88.—Identified with Beit Rima.

Theraspis.—Identified by Clermont-Ganneau (PEFQS, 1897, p. 218) with the ruins of Deir Asfin.

Betomelgezis.—Clermont-Ganneau (PEFQS, 1897, p. 218), suggests the Bethmelchi or Bethmelchis of the Crusaders in the neighborhood of Mejdel Yaba.

Adiaeim (or Adiathim), now Aditha.—Jacoby (p. 71) suggests the modern El Haditha near Diospolis and refers to I Maccabees xii, 38; xiii, 13; Josephus, War, IV, 9, 1.

3. JERUSALEM AND SURROUNDING REGION.

Jerusalem.—Above the city plan is read in large red characters, "Holy city Jerusalem." For the various parts of the city itself are used green, red, yellow, black, and white. Contrary to the later medieval plans of Jerusalem, which have a circular outline (perhaps influenced by the idea that Jerusalem was the center of the world), divided into four quarters by two streets crossing one another at right angles, the plan of the city on the mosaic is oval or elliptical, with the streets running parallel to one another. The southeast corner is destroyed on the mosaic. The city is surrounded by a wall, which on the east side shows an irregular line of jutting-out towers and buildings. A series of gates provides for the intercourse of the city with the outside.

Entering the city from the north (left) side there is a gate flanked by two towers leading to a semicircular space on which is a column. It corresponds to the modern Damascus Gate, which still bears the name of "gate of the column (Bab el-amud)." From this gate issue two streets, lined on either side with columns. One of the streets runs in a straight line almost through the entire length of the city; the other makes about midway a bend eastward, crossing a lesser artery which enters from the eastern gate, and thence proceeds due south, parallel to the main street. The western colonnade of the main street is broken by steps leading through three portals to a great church building which abuts on the west wall. It is generally agreed that it represents the church of the Holy Sepulchre built by Constantine and Helene and dedicated in 336 (Eusebius, Life of Constantine, III, 37). It consists of a basilica, the *Martyrium,* on the alleged site of Golgotha, and a rotunda in the middle of which was the tomb of Jesus, called the *Anastasis* (place of the resurrection). The basilica is at the east and the rotunda at the west. At the northeast extremity of the city is another church, perhaps that of the Nativity of the Virgin (now St. Anne). The gate in about the middle of the east side corresponds to the present St. Stephen's Gate (Bab Sitti Mariam) and the street issuing from it westward would be the Via Dolorosa of tradition. South from it is another gate—the Golden Gate (Bab el-Daheriyeh). The large building at the southwest, at the end of the main street, may represent the Church of Holy Zion, also known as the church of the Last Supper (*Caenaculum*). On the west side one gate can be discerned, which would answer to the present Jaffa Gate (Bab el-Khalil).

It may be assumed that the picture of Jerusalem on the mosaic, which bears evidence of being executed with great care, preserves a good summary of the city's main features in the time of Justinian.

Above, near the Jordan: *Bethabara,* of the Holy John of the baptism.—Supply: Sanctuary, or church of ———. But even so the construction is curious and shows that the mosaist's knowledge of Greek was not very strong. Eusebius (O S, p. 58) has "B———, where John was baptizing," and adds: "The place is still shown, where many of the brethren (i. e., Christians) like to be bathed."—It refers to the narrative in John i, 28, where some scholars read (after some old manuscripts) Bethania instead of Bethabara.[1]

Alon Atath, which is now called Bethagla.—Eusebius (OS, p. 8) has: "Alon Atad, which is across the Jordan. Here they mourned Jacob. The place is three (Roman) miles distant from Jericho and about two (Roman) miles from the Jordan, and is now called Bethagla, which means circuit, because here the mourners made a circumambulation around Jacob."—It refers to the narrative in Genesis l, 10. (Where the English Version has, "threshing-floor of Atad"). Both Eusebius and the mosaist following him, erroneously identify the mourning station of Jacob with Beth-Hogla (Joshua xv, 6). The former was probably east of the Jordan, while the latter is on the west bank of the Jordan, identical with modern Ain (or Kasr) Hajla, between Jericho and the Jordan, south of Gilgal.

Ephron or Ephraia.—The original has the additional legend: "Thither went the Lord," and Eusebius (OS p. 90), adds: "with his disciples."—John xi, 54, compare II Chronicles xiii, 19.

To the right of the last-named place, *Ailamon,* here the sun stood still by (the son) of Naue (Nun).—Refers to the episode of Joshua x, 12 (where the Septuagint transcribes Ajalon by Ailon).—Eusebius (OS, p. 18), more correctly—"the sun stood still in answer to the prayer of Joshua," and adds: "Still at present a village called Ailon, three (Roman) miles east of Bethel, near Gabaata and Rama, the cities of Saul."

To the north of Jerusalem and close to the periphery of the city is the name of *Benjamin* and the prophecy bearing on it, which was referred to previously (p. 363). Further down: The Fourth, and Nine, which are interpreted to refer to Roman military stations or garrisons. Underneath to the south is,

Bethhoron.—Joshua x, 10; xvi, 3, 5.—Represented to-day by Beit Ur el-Foka and Beit Ur el-Tahta, near it.

Erouta.—Clermont-Ganneau (PEFQS, 1897, p. 220 and 1901, p. 238), identifies it with Kefr Rut near Beit Ur el-Tahta, to the west-northwest; Schulten (p. 94), sees in it Kirjath-Jearim, Joshua ix, 17; xv, 9, 60, etc., which Eusebius (OS, p. 114) places at the ninth milestone from Jerusalem towards Diospolis or Lydda. This would suit the position of Karyet el-Enab, which is about three hours from Lydda. Below,

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[1] See G. A. Smith, Historical Geography of the Holy Land, p. 496, n. 542, PEFQS, 1875, p. 72; 1878, p. 120; 1881, p. 46.

Modeeim, now *Moditha,* whence came the Maccabeans.—Modern el-Medieh, Underneath,

Lod, which is *Lydea* and also *Diospolis.*—The Biblical Lydda or Lod, Ezra ii, 33; Nehemiah vii, 37; Acts ix, 32. It was an episcopal see and the place of St. George. To the right,

Thamna, here Judah shore his sheep.—The Biblical Timnah, Genesis, xxxviii, 12, Joshua xv, 57, Underneath,

Anob, which is now Betoannaba.—Anab, Joshua xi, 21, xv, 50, Modern Annabe.

4. BETWEEN JERUSALEM AND THE DEAD SEA.

Across (east of) the Jordan below the scene of the gazelle chased by a panther or lion,

Aenon, where now is Sapsaphas.—As in the case of the mountains of Ebal and Gerizim (see above, p. 367) so, it seems, there also was current a double tradition as regards the site of Aenon where John baptized, the one placing it (correctly) near Salim (see above, p. 366), the other near Bethabara, and the mosaist took account of both traditions. To the right,

Hot spring of Callirhoe.—Mentioned in Pliny's Natural History, V, 16, 72, Josephus, War, I, 335. Identified with modern Hammam ez-Zarka Main. West of the Jordan,

Thekoue.—Biblical Tekoa, Birthplace of the prophet Amos, II Samuel xiv, 2; Amos i, 1, etc.

Bethlehem—Ephratha.—On the Mosaic as well as in the Onomasticon (pp. 45, 82, and 172) Bethlehem and Ephrathah are noted as two separated localities, while usually they are identified and Ephrathah is considered as cognomen of Bethlehem. It may be that Ephrathah was the name of the whole district in which Bethlehem lay; compare Genesis xxxv, 19; Micah v, 2. Modern Bit Lahm.

Rama . . . See p. 368.

Akl Damma, Compare Matthew xxvii, 8.

Bethhoron.—Wrongly placed on the reproduction; see p. 370.

Nikopolis.—A later name of Emmaus, Luke xxiv, 13; compare I Maccabees, ix, 50; Josephus, Antiquities, XIII, 1, 3. It is still preserved under the name of Amwas.

Gedour, which is also called *Gidritha.*—The site would suit the Biblical Gezer, while the name suggests Gedor, Joshua xv, 58, modern Jedur, six miles north from Hebron. Eusebius (OS, p. 68) registers the place under Gedour and Gedrous and states that it was situated ten (Roman) miles from Diospolis (Lydda).

Enetaba.—Identified by Clermont-Ganneau (PEFQS, 1897, p. 221) with En Tab in the Talmud.

Geth, which is also called *Gitta*, one of the five capital cities.—Biblical Gath, one of the five royal or princely cities of the Philistines, Joshua xiii, 3; I Samuel vi, 17, etc.

Iabnel, which is also called *Iamnia*.—*Jabneel*, Joshua xv, 11; Jabneh, II Chronicles xxvi, 6. Below is,

Safrea.—So read by Clermont-Ganneau (PEFQS, 1901, p. 238) and identified by him with modern Safiriyeh. To the right is,

(*Sanctuary*) *of the holy Jona*.—Otherwise unknown.

5. THE SURROUNDINGS OF THE DEAD SEA.

Khara Moba.—Biblical Kir Moab, Isaiah xv, 1, modern Kerak, about ten miles from the southeast corner of the Dead Sea. It was an episcopal see.[1]

Betomarsea which is also called *Maioumas*.—Clermont-Ganneau (PEFQS, 1901, p. 239): "Büchler (Revue des Etudes Juives, 1901, p. 125) has just demonstrated . . . that Betomarsea is no other than the transcription of Beit Marzeah (comp. Jeremiah xvi, 5),[2] that Marzeah, or Marzeiha, means, like Maioumas, a great Syrian feast of licentious nature, and that this double denomination must apply in this case on the map to the place where popular tradition located the famous scene of the fornication of Irsael, when they allowed themselves to be initiated by the beautiful daughters of Moab into the impure rites of Bael Peor" [3]

Aia.—Jacoby (p. 93) would see it in Ai of Jeremiah xlix, 3, situated not far from Heshbon; Clermont-Ganneau (PEFQS, 1897, p. 220) identifies it with the Aie of Eusebius (OS, p. 10), which the latter places to the east of Areopolis-Rabbath Moab.

Tharais.—Clermont-Ganneau (PEFQS, 1897, p. 220) suggests modern Khurbet Talha, between Kerak and the Dead Sea.

Barou.—So is the *arou* on the original read and referred to St. Jerome (OS p, 44), where he says: "There is to the present day an important place near Baaru in Arabia where hot water bubbles up from the ground, etc."; compare also Josephus, War, VII, 6, 3, where a place by the name of Baaras is mentioned.

Dead Sea.—The superscription reads: Salt Sea (see Numbers xxxiv, 3, 12, etc.); Asphalt sea (Josephus, Antiquities, I, 9, 1), and Dead Sea. West of the Dead Sea is,

Bethsoura Sanctuary of the holy Philip. Here it is said the Kendake ennuch was baptized.—Refers to the story of Acts viii, 26 and following. The mosaist made of the queen Kandake a people. Bethzur of Joshua xv, 58.

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[1] Compare Proceedings of the Society of Biblical Archaeology, 1901, p. 240.

[2] In the English Bible, rendered "house of mourning."

[3] Compare Numbers, chapter xxv.

The oak which is also called the *terebinth of Mamre*.—Genesis xiii, 18. Eusebins (OS, p. 76) adds, "To the present is the terebinth shown," and St. Jerome (OS., p. 77) says that it was pointed out in his infancy and down to the reign of Constantius (337–361). According to Sozomen, Hist. Eccl., ii, 4, 1–2, the place was sacred to Christians because the Son of God appeared there with two angels to Abraham (Genesis xviii, 1–2).

Sokhoh.—Socoh, Joshua xv, 35, etc.

Saphitha.—Clermont-Ganneau (PEFQS, 1897, p. 222) identifies it with modern Tell es-Safie.

Beth Zakhar.—A fortress Beth-Zacharia is mentioned in I Maccabees VI, 32, compare Josephus, Antiquities, XII, 9, 4; War I, 1, 5.

Sanctuary of the holy Zecharia.—Probably meant the tomb of the prophet Zachariah. But early the prophet was confounded with the father of John the Baptist, Luke i, 5, and with both was confounded the Zechariah of Matthew xxiii, 35.

Morasthi, whence came the prophet Micah.—Mareshah, Micah i, 1, 15; Jeremiah xxvi, 18.

Geth which is now called *Akkaron*.—*Ekron*, one of the five cities of the Philistines, I Samuel vi, 17, etc. The mosaist confounded it with Gath. To the south is,

Asdod, and farther down, *Azotos* on the sea.—Both refer to the Philistine city of Asdod, I Samuel vi, 17, etc. There were distinguished two Asdods, one on the sea, the other inland. Both cities, which were about one hour distant from one another, were connected by several small towns (Jacoby, p. 57).

Askalon, and to the right, *Gaza*.—Both likewise cities of the Philistine Pentapolis, I Samuel vi, 17, etc.

6. SOUTH OF THE DEAD SEA AND EGYPT.

On top is the picture of a shrine, but the name of the saint whose name it bore has dropped out.

Balak, which is also called Segor and Zoora.—Zoar, Genesis, xiii, 10; xix, 22, etc.

Bersabee, which is now called *Berosabba*. So far extend the borders of Judea southward, from Dan to Paneas which limits it in the north.—Beer-sheba, Genesis xxi, 31; xxvi, 23; Joshua xv, 28, etc. Modern Bir es-Saba. From Dan to Beer-sheba was measured the extreme length of Palestine.

Gerara, once a royal city of the Philistines and border of the Canaanites toward the south. Here was the Geraritic Grove.—Gerar as royal seat of the Philistines is mentioned, Genesis xx, 2; xxvi, 1. It is identified with modern Umm-Jerar, near Gaza (See Genesis x, 19), or (less probably) with Wadi Gerur.

Oga.—Jacoby (p. 52) reads Adroga and refers to Reland, Palaestina, p. 222 and 228.

Asalea.—Jacoby (p. 52) refers to Sozomen, Hist. Eccl. iii, 14.

Sobila.—Unknown.

Bethagidea.—Unknown.

Edrain.—Clermont-Ganneau (PEFQS, 1897, p. 223); "Perhaps Khurbet el-Aar, eight kilometers south-southeast of Gaza"; Jacoby (p. 52) identifies it with Eder, Joshua xv, 21.

Thauatha.—Jacoby (p. 53) refers to Thabatha in Sozomen, Hist. Eccl. iii, 14.

Sanctuary of St. Victor.—A St. Victor 1, Pope from 189 to 198 or 199, is mentioned in the Catholic Encyclopedia, vol. 15, p. 418.

Prasidin.—Is generally taken to be Latin *praesidium*; that is, military station or garrison.

Thamara.—Eusebius (OS, p. 8) has: "Asasan Thamar (i.e., Hazezon Tamar, Genesis xiv, 7). There dwelt the Amorites whom Chedorlaomer cut down. It is said that Thamar is a day's journey from Mampsis on the road from Hebron to Jerusalem, where at present a garrison is located."

Mod.—Unknown.

Mampsis.—See above under Thamara.

Arad, whence are the Aradites.—Arad was a southern Canaanitish town, Joshua xii, 14, etc., modern Tell Arad, southeast of Hebron, while the Aradites were the inhabitants of Arvad, Genesis x, 18. Ezekiel xxvii, 8, 11, modern Ruwad. The mosaist confounded them with the inhabitants of Arad.

Jethor, which is also called *Jethera.*—Jattir, Joshua xv, 48; modern Attir.

Orda.—Clermont-Ganneau (PEFQS, 1897, p. 223): "The position would suit Khurbet Umm Adra, transposing the d and r."

Seana.—Clermont-Ganneau (PEFQS, 1897, p. 223) identifies it with Kh. Sihan, about nine kilometers southeast of Gaza.

Madebena, which is now called *Menois.*—Madmenah, Isaiah X, 31.

Sykomazon.—Was an episcopal see.

Ostrakine.—Frequently mentioned (see Josephus, War, IV, 11, 5; Pliny, Natur-Hist., V, 14). According to a legend the prophet Habakkuk fled thither before Nebucadnezar from Jerusalem. Tradition also located there the tomb of the Apostle Simon, who carried the Gospel as far as Egypt.

Rhinokoroura.—The name occurs in the Greek translation of the Septuagint to Isaiah xxvii, 12; see Eusebius and St. Jerome (OS, p. 148–9). Pliny, Natur. Hist., V, 14, mentions it under the name of Rhinocolura. It was a border city between Syria and Egypt and seat of a bishop. Underneath are, *Borders of Egypt and Palestine—Raphidim.*—Here Israel fought Amalek, Exodus xvii, 8–14.

Asemona, a city in the desert, dividing Egypt and the passage to the sea.—Hashmonah, one of the camping stations of the Israelites in the desert, Numbers xxxiii, 29.

Elousa.—Mentioned in Ptolemy, Geography (second century A. D.) V, 16, and Stephen of Byzanz, Ethnica (sixth century A. D.), 119, 19. Modern Halasa. Formerly seat of bishop.

Photis.—Clermont-Ganneau (PEFQS, 1897, p. 223) identifies it with Khurbet Futeis or Fetis, situated half way between Gaza and Beer-sheba.

Desert, here Israel . . . . the brazen serpent.—Refers to the narrative in Numbers xxi, 8 and following.

Desert of sin, here the manna and the quails were sent, Exodus xvii and Numbers xi, 31.

Pelonsin.—Pelusium (the inscription to the picture is wanting in the reproduction). On the mosaic it is wrongly placed on the western bank of the Pelusian Nile arm instead of on the east side. The city is frequently mentioned elsewhere and was an episcopal see.

Nikios.—Was likewise seat of bishop.

Athribis.—Mentioned in Ptolemy, IV, 5, 51, and Stephen of Byzanz, 17, 3.

Sethroites.—Mentioned in Ptolemy, IV, 5, 53. It was the name of an Egyptian Nome (province), with Heracleapolis as capital.

Tanis.—The Biblical Zoan, Numbers xiii, 22, etc. Modern San. According to a legend, based on Psalms lxxviii, 12 and 43; Isaiah xix, 11 and 13, it was the birthplace of Moses.

Thmois.—Mentioned in Stephen of Byzanz, 139, 1, etc.

Thennesos.—Was an episcopal see.

Xois.—Frequently mentioned elsewhere. On the mosaic the sites of Xois and Sais (which is wanting in the reproduction) are transposed.

Paulinos.—Unknown.

Hermoupolis.—Modern Damanhur.

Khortaso.—Only mentioned in Stephen of Byzanz, 311, 11.

Kainoupolis.—Unknown.

APPENDIX. THE INSCRIPTIONS ON THE DRAWING.

The inscriptions seen in the left lower corner and the right upper corner of the drawing have no connection with the mosaic map, but were found on the mosaic floor of another church in Medeba over which houses have been built, and have perhaps been joined to the map for the sake of preservation. They read:

1. In the round vignette on the left side: "In gazing upon the Virgin Mary, Mother of God, and upon Him whom she has borne,

Christ the Sovereign King, only Son of the only God, be thou pure in mind and flesh and deeds, in order that thou mayest by thy pure prayers (help) the mortal people."

2. In the rectangular vignette: "The very beautiful mosaic work of this sanctuary, and of the holy house of the altogether pure Sovereign Mother of God (has been made) by the care and zeal of this town of Madeba for the salvation and the reward of the benefactors, dead and (living) of this sanctuary. Amen, Lord! It was accomplished by the aid of God in the month of February of the year 674 induction 5." As it is not known after what era the years were reckoned, the date can not be determined. If the Seleucidan era was intended, the year 674 would correspond to 362 or 363 A. D.

3. To the right in one line: "Holy Mary help Menas IV." Perhaps referring to some bishop or another prominent man who was buried in the church.[1]

4. The three vignettes on the upper right corner: "Christ God reared this house under the holy Sergius, bishop of the same by the zeal of the presbyter Sergius, son of the Holy Aelianus in the year. * * * "[2]

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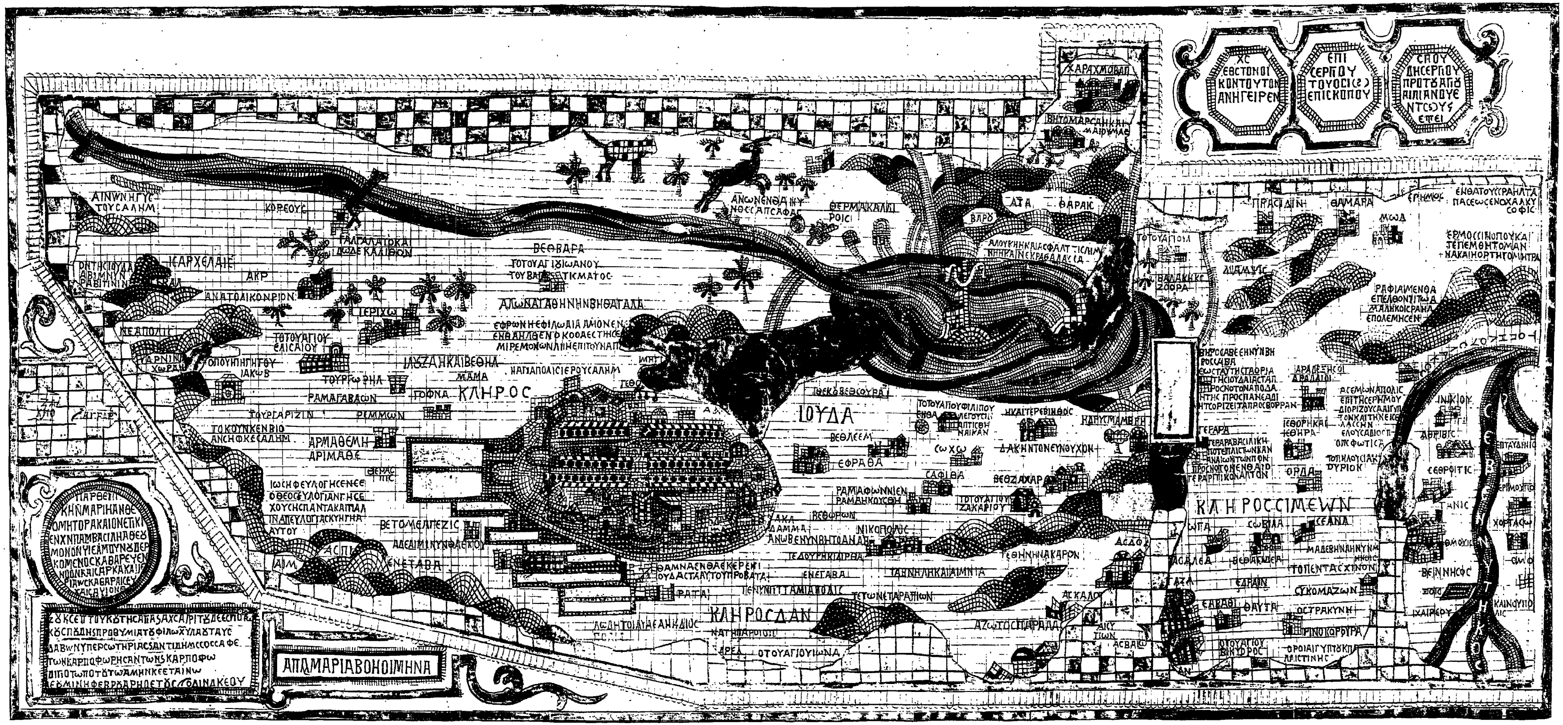
[1] See PEFQS, 1895, pp. 208-210; also Kubitschek, p. 368. Nevue Biblique, vol. 7, 1898, pp. 422, 643.

[2] For a discussion of the date, see Clermont-Ganneau, PEFQS, 1897, p. 224.



THE MEDEBA MOSAIC MAP OF PALESTINE.

AN ALBINO SALAMANDER, SPELERPES BILINEATUS.

By Arthur M. Banta and Ross Aiken Gortner.

Of the Carnegie Station for Experimental Evolution, Cold Spring Harbor, New York.

In May, 1912, while collecting amphibian material in the field the writers took an albinotic (a xanthic) larva of *Spelerpes bilineatus* Green. The larva was a year old and measured about 4.3 centimeters in length. It was colored a uniform yellowish orange, except for the gills, which were reddish from contained blood, and the eyes, which appeared opaque white. While this individual entirely lacked black pigment in the skin, eyes, and connective tissue as well, it had the normal amount of yellow pigment. In fact the animal was so conspicuously yellow that it seemed hard to believe that it did not have more than the normal amount of this pigment; but a close examination of the skin of normal individuals convinces one that there is a large amount of the yellow pigment, but that it is pretty thoroughly masked by the large amount of melanin present.

The color of this albino larva was recorded by using one of the Milton Bradley color tops. The exact shade of the body color was most nearly matched with the following percentages: Black, 39; white, 9; orange, 28½; and yellow, 23½. A normal of the same size and apparent stage of development was matched on the head region with: Black, 74½; white, 8; orange, 4; yellow, 13½. The body region was recorded as: Black, 85½; white, 4; orange, 2; and yellow, 8½. The percentage of black given in the color record of the albino does not indicate partially concealed black pigment, but was necessary in order to obtain the proper density of the orange yellow.

The albino was kept in a large battery jar provided with water, sand, and stones, and was fed upon small annelids and slender strands of beef. It took food very well and grew rapidly. It began to resorb its gills early in the following October and completed its transformation in two or three weeks. During transformation it became distinctly more orange in color than it had previously been and there appeared two distinct dorsal lines not evident before. These bands were at either side of the median line running back from just in front of the shoulder region to well along the base of the tail, in the position occupied by the heavily pigmented bands in the normal. They were of a peculiar dull opaque yellow appearance, in contrast with the soft, transparent orange yellow of the general body color.

The color drawing, reproduced in the plate (Plate 54), was made in July, 1913. The normal drawn (Plate 55) was of almost the same size and, as nearly as one could judge, of the same stage of development as the albino. The artist's "high light" interfered with the proper representation of the opaque line on the left side of the albino.

The presence of the normal amount of yellow pigment and entire absence of black pigment in the albino indicates in a most interesting way that the black and yellowish-orange pigment in Spelerpes are inherited independently of each other and that they have a different chemical origin. The writers hoped to rear the albino to sexual maturity and secure offspring from it, but although it had been taking food regularly it died in August, 1913.

An oft-repeated search in the locality where the albino was secured failed to reveal other albinos.

An albino strain of the axolotl has been reared in captivity for nearly half a century. So far as the writers are aware this is the only unquestioned albino urodele on record. The cave-inhabiting *Proteus anguineus* is sometimes referred to as an albino, but it is distinctly not an albino, as has been abundantly proven by the production of pigment in individuals kept for some months in daylight (Zeller, '88; Viré, '04, p. 707). Whether the pigmentless *Typhlomolge rathbuni* (Stejneger, '96) of the Texas underground waters is an albino, in that it lacks capacity for pigment production under conditions suitable for its development, has not been determined.

In his discussion of cases of albinism in amphibians Pavesi ('79) refers to some reputed but doubtful cases of albino urodeles. The only case the description of which has been examined by the writers is that of a *Salamandra maculosa* referred to by Latreille ('02, p. 220),[1] though this case, too, was called in question by later writers. There are numerous records in the literature of so-called partial albino urodeles. Many of these, however, are merely slightly pigmented individuals, such as occur frequently in amphibian material reared under laboratory conditions and probably have no genetic significance.

Britcher ('99) discovered pigmentless eggs of *Ambystoma punctatum*, but in the course of development the normal amount of pigment was produced. Such a case is comparable to what normally occurs in the development of Cryptobranchus, Spelerpes, Plethodon,

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[1] This is not the original description, for as Dr. Stejneger suggests "Latreille (1802) only refers to the Paduan albino Salamandra at third hand. It was apparently first described and figured in 1683 by Wurffbain (Salamandrologia, pl. 2, fig. 1). In 1768 Laurenti gave this specimen a binominal appellation *Salamandra candida* (Syn. Rept., p. 41) quoting Wurffbain. Latreille took his reference to this specimen from Gmelin's Syst. Nat., 1789."

Desmognathus, and other colorless amphibian eggs which produce pigmented larvae. During the season of 1914 Prof. T. H. Morgan, of Columbia University, procured pigmentless eggs of the common toad and kept them through their development until they were nearly ready to transform. Early in their development they acquired the normal pigment for toad larvae. The larvae were distributed in convenient ponds at Cold Spring Harbor in the hope of finding more of the same sort of eggs again.

A number of cases of albino anurans have been reported in European species. Pavesi ('79) and Boulenger ('97, pp. 28–29) report such cases and review a number of those reported by others. These albinos include larvae of *Rana esculenta*, larvae and adults of *Rana temporaria*, a *Bombinator pachypus*, larvae of *Bufo viridis*, and larvae and adults of *Alytes obstetricans*. Of the last-named species Héron-Royer ('86) reared adult albinos from albinotic larvae and in turn got offspring of the same sort from them. Most, at least, of these albino anurans were unquestionably xanthic specimens, possessing abundant yellow pigment, as our Spelerpes did.

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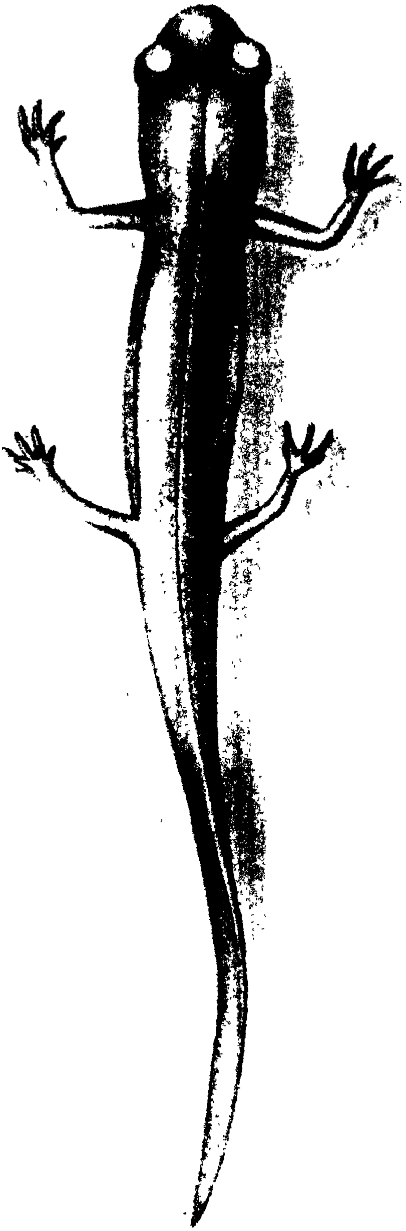

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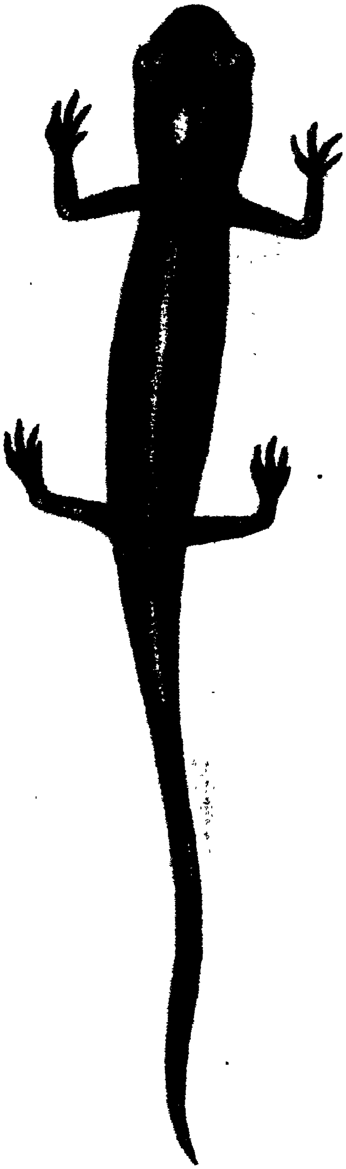
ALBINO SPELERPES BILINEATUS (GREEN) X 4.

FOR EXPLANATION OF PLATE SEE PAGE 378.



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NORMAL SPELERPES BILINEATUS (GREEN) X 4.

FOR EXPLANATION OF PLATE SEE PAGE 378.

A CONTRIBUTION TO THE KNOWLEDGE OF THE EXTINCT SIRENIAN DESMOSTYLUS HESPERUS MARSH.

By Oliver P. Hay,

Research Associate of the Carnegie Institution of Washington.

The genus *Desmostylus* has been the subject of a number of papers and its position among the mammals a matter of some dispute. The genus was described by Marsh in 1888.[1] Exactly what parts of the animal Marsh had at his disposal the writer does not know. There were some teeth or parts of them; and a lumbar vertebra is mentioned as being one of the best preserved specimens. His figures are views of a part of one tooth. The materials had been found in Alameda County, California; and, according to Marsh's knowledge, had been associated with a morotherium, a mastodon, a camel, and one or more extinct species of horses. All these were regarded by Marsh as indicating the Pliocene age of the animal. He referred the genus *Desmostylus* to the Sirenia.

In 1891 Flower and Lydekker[2] mentioned the genus and referred it to the Halicoridæ. The next discussion of the genus appears to have been that of Prof. H. F. Osborn,[3] in 1902. Osborn's remarks were occasioned by a paper published by Yoshiwara and Iwasaki.[4] This last mentioned paper will be frequently referred to in the present article. In Osborn's communication there was incorporated a note sent him by Prof. John C. Merriam, of the University of California, in which the latter discussed the geographical range of the genus. He informs us that besides the specimens of teeth in Marsh's hands there were others known to him. One of these had been found in "Canores Cañon, in the foothills of the west side of the lower end of the San Joaquin Valley." Another tooth, in the museum of the California Academy of Science, was of unknown origin. A third was in the hands of the late Professor Condon of the University of Oregon and had been picked up on the beach of Yaquina Bay, Oregon. Merriam stated that the Californian specimen appeared to have come from fresh-water beds of late Tertiary or Quaternary age. None of these materials threw any additional light on the nature of the animal which was going under the name of *Desmostylus.*

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[1] Amer. Journ. Sci., ser. 3, vol. 35, pp. 94-96, figs. 1-3.

[2] Mammals, living and extinct, p. 223.

[3] Science, n. s., vol. 16, pp. 713, 714.

[4] Journ. College Science, Imp. Univ. Tokyo, vol. 16, art. 6, pp. 1-13, pls. 1-3, 4 text figs.

Yoshiwara and Iwasaki, in the paper cited, described a part of a skull of an animal whose relationships were not definitely determined by them and to which they gave no generic or specific name. However, they concluded that the animal was a proboscidean, but they also recognized its sirenian relationships. The specimen presented the front end of the skull from the snout to the rear of the upper maxillae and the lower jaw from the front to a point below the orbit. The length of the specimen was 550 mm., about 21.6 inches. It presented a number of teeth; and these, in the paper published, were beautifully figured. On the publication of this paper both Osborn and Merriam recognized that the animal belonged to Marsh's genus *Desmostylus;* and this recognition led to the communication made by Osborn to Science in which Merriam's note is contained.

In 1906 Merriam [1] published a paper on the subject, in which he noted two additional finds of teeth of *Desmostylus.* One specimen had been obtained at La Panza, San Luis Obispo County, California; the second lot, near Santa Ana, Orange County, in the same State. Both lots occurred in marine shales of Miocene age. Thus the animal had been found in three cases in marine deposits of Miocene times, once at Yaquina Bay, Oregon, and in two places in the southern half of California. This sufficed to prove that there was some error in Marsh's statement that the *Desmostylus* teeth had been found associated with extinct horses, camels, and edentates. The error may have arisen on the part of the collector of Marsh's materials.

In 1911 Merriam published additional notes on *Desmostylus.*[2] In this paper he showed that Marsh's type had not been found in Alameda County, but in Contra Costa. Merriam regards the genus as belonging to the lower Miocene.

In April of the present year I received from Mrs. Ellen Condon McCornack, of Eugene, Oregon, a letter in which she informed me that Mr. J. G. Crawford, of Albany, Oregon, had in his possession a skull which she believed to belong to some sirenian. Mrs. McCornack enclosed photographs of this specimen and likewise a sketch of a tooth which is in the University of Oregon. This is quite certainly the tooth which is mentioned by Merriam as having been in the possession of Professor Condon. Mrs. McCornack is the daughter of Professor Condon and takes great interest in the subjects which occupied the attention of her father.

As a result of negotiations with Mr. Crawford the skull, together with a tooth of probably another individual and two cetacean vertebrae, was purchased for the United States National Museum. It has the catalogue number 8181.

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[1] Science, vol. 24, pp. 151-152.

[2] Bull. Dept. Geol. Univ. Calif., vol. 6, pp. 403-412, figs. 1-11.

This skull, according to information furnished by Mr. Crawford, was found in Miocene shales at the mouth of Spencer Creek, which flows into Yaquina Bay. From Mrs. McCornack I learn that it was about eight miles farther south that was found the fossil seal, *Desmatophoca oregonensis*, which was described by Professor Condon[1] in 1906. Mr. Crawford found the skull yet enclosed in the rock on the beach, with the palatal surface upward and washed by the waves; and he chiseled it out with some of the matrix adhering. This matrix is exceedingly hard and it adhered closely to the bone; and with difficulty it has been removed since the skull was brought to the United States National Museum. The skull was found in the year 1907.

The skull has suffered some injuries. The lower jaw is gone. The snout is missing nearly as far back as the rear of the external nares; and just behind this opening some bone is missing as a result of a transverse fracture. A part of the occipital crest is missing on one side. The crowns of all the teeth which had been in use are broken off. Other slight injuries occur here and there. It is evident that the skull belonged to Marsh's species *Desmostylus hesperus* and that the Japanese skull already mentioned belonged to a closely related species. The two skulls in many ways supplement each other. The Japanese skull was nearly twice as large as the Oregon specimen.

The following measurements have been determined:

Measurements of skull of Desmostylus hesperus, in millimeters.

Extreme length of skull, as preserved	310
Basilar length, about	360
From front of foramen magnum to rear of hard palate	110
From front of foramen magnum to palato-maxillary suture	175
From front of foramen magnum to front of basisphenoid	55
From outside to outside of occipital condyles	109
Foramen magnum, width from side to side	42
Foramen magnum, height of	27
Width of skull from outside to outside of mastoids	190
Width of skull on zygomatic arch, just over ear cavity	194
Width of supraoccipital bone	128
Width of brain case at center of squamosals	123
Length of parietal bone on midline	55
Greatest length of parietal	140
Width of parietal at hinder end	132
Distance between anterior processes of parietal	76
Length of suture between the frontals	106
From rear of frontals to line joining their front ends	150
Length of suture between the nasals, about	100
From outside to outside of nasals	30
Distance across skull at supraorbital processes	111
Width of skull at constriction behind orbits	80

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[1] Condon, Univ. Oregon Bull., vol. 3, No. 3; Wortman, Science, vol. 24, p. 89.

Width of skull across zygomatic arches, at front of the glenoid fossæ	210
Width of skull at front of zygomatic processes of the temporal bone	190
From front of one orbit to front of the other	93
Width of snout at the rear of the nasal opening	77
Width of hinder nares	54
Width of palate between second molars	65
Width of palate between front premolars	68

It seems best, first of all, to compare briefly *Desmostylus* with other sirenians. From all existing forms it differs in having the snout little bent down on the axis of the cranium (pl. 58, fig. 1). Yoshiwara and Iwasaki state that in their specimen the jaws showed no trace of a downward curvature, but one has only to view their plate 2 to see that there is a downward flexure of the face about halfway between the tip of the snout and the orbit. However, in Owen's *Prorastomus,* from the Eocene of Jamaica, the jaws appear not to have been bent at all downward. In *Desmostylus* the flexure so commonly found in sirenians is just beginning to manifest itself. It appears to be somewhat more strongly developed in *D. hesperus* than in the Japanese form. Another feature of *Desmostylus* which distinguishes it from most of its kindred is the small size and the anterior position of the external narial opening. This is about the size of the orbit, and has its anterior border a short distance behind the front of the jaw and far in advance of the orbits. In a specimen of manatee from Demarara River it begins quite as far in front, but it extends far behind the orbit and is equal to nearly one-half of the length of the skull. In *Prorastomus* the nostril is about the size of the orbit, but its rear comes nearly to the front of the latter. In the Eocene sirenians of Egypt, *Eotherium* and *Eosiren,* as described and figured by Andrews,[1] the external nasal opening is rather large and extends back to or beyond the front of the orbit.

In *Desmostylus* the nasals are less reduced than in other known sirenians (pl. 56). The brain case is less compressed than in most sirenians and there are very feebly developed temporal ridges. Something like this condition seems to be found in *Eotherium.*[1] The teeth of *Desmostylus* differ greatly from those of other Sirenia. In the lower jaw there are two pairs of tusks.[2] The molars consist of a varying number of closely appressed columns which spring from the base of the crown.

In all the ways mentioned in which this skull differs from that of other described sirenians, except the teeth, it is more primitive than the hitherto described forms, except probably *Prorastomus.* Evidently the animal will enter none of the families hitherto proposed. A separate family must be constituted for it, and naturally it must take the name

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[1] Andrews, Catalogue of the Tertiary Vertebrata of the Fayûm, Egypt, p. 206.

[2] Yoshiwara and Iwasaki, Journ. College Scien., Imp. Univ. Tokyo, vol. 16, p. 5.

DESMOSTYLIDAE, new family.

Diagnosis of family.—Snout and lower jaw elongate and only slightly bent downward. Nasal opening small and far in advance of the orbits. Brain case more inflated behind and not compressed in front, and the temporal ridges feebly developed. Upper jaw with one pair of possibly latent tusks; lower jaw with two pairs of horizontal protruding tusks. Molars high crowned, composed of two longitudinal rows of appressed columns, with sometimes one or more intercalated columns.

The only genus at present known to belong to the family is *Desmostylus,* the diagnosis of which must be the same as that of the family, as above given. To this genus belongs the type *Desmostylus hesperus* Marsh, here to be described, and the Japanese species to be named below.

As will be seen from the illustrations (pls. 56–58), the skull is elongate, the snout rather narrow and prolonged, but truncated in front. The undulating surface of the occiput makes slightly less than a right angle with the axis of the skull. Along the midline, beginning behind, the surface is convex over the brain case, concave behind the orbits, then again convex to the descending snout. Viewed from above there appears in front of the orbits no such sudden contraction in width as is seen in *Trichechus* and *Halicore.* On the left side the contraction seems to be more abrupt because of the lack of some bone. According to Andrews' figures, the contraction in the width is abrupt and considerable in *Eosiren;* while in *Eotherium,* although the reduction in width is less sudden, it continues nearly to the front of the snout. Apparently the center of the orbit in *Desmostylus* is very nearly halfway from the occipital crest to the front of the snout. This was the position of the orbit in *Prorastomus* and apparently also in *Eotherium,* both belonging to the Eocene.

The supraoccipital (pl. 58, fig. 2) joins the exoccipitals below and the parietal above. Its outer angles barely come into contact with the squamosal. In the lower half of the midline of the supraoccipital there is a shallow groove; in the upper half a slight ridge, which upwardly expands into the occipital crest. This crest is formed principally by the supraoccipital as far as the latter extends. On each side of the ascending ridge the bone is slightly excavated. It does not enter into the boundary of the foramen magnum.

The exoccipitals and the basisphenoid form a single mass. The suture in front of the latter is yet open. The exoccipitals meet above the foramen magnum a distance of 12 mm. The occipital condyles are sessile. The foramen is wider than high and is notched neither above nor below. Laterally, the exoccipital comes into contact with the upper hinder angle of the squamosal for a distance of 28 mm.; below this it joins the mastoid portion of the petrosal bone apparently to the lower end of the paroccipital process. These processes probably extended down to the level of the lower surface of the occipital condyles; but the latter are slightly eroded, the former considerably. From the paroccipital process a strong ridge extends forward and joins the petrosal ridge; while higher up, in front of the mastoid, the base of the paroccipital process joins for a short distance the squamosal. In front of each of the condyles is a large condylar foramen. From the mesial border of one of these to that of the other, across the basioccipital, is a distance of 60 mm. The width of the anterior end of this bone is 47 mm. The bone is nearly flat on its lower surface. In each upper outer angle of the exoccipital is a deep depression, quite certainly a foramen; but the matrix has not been removed entirely. The height of the rear of the skull from the upper lip of the foramen magnum is 100 mm.; from the lower lip, 122 mm.

The parietal (pls. 56, 58) is a large bone which has many of the characteristics of that of *Trichechus*, but it is more extended fore and aft. Along the midline there are on the surface many fine twisted lines and grooves which suggest that a median suture had only recently closed.

Weber[1] in speaking of the sirenians states that the parietals are united in a sagittal suture, but in a skull of *Trichechus* and one of *Halicore* at hand there are seen no traces of this suture. It is present in skulls of *Hydrodamalis* (*Rhytina*). On each side, the parietal sends forward a narrow process which reaches nearly to the rear of the orbit. In the wide notch between these is received the hinder ends of the frontals. In both *Trichechus* and *Halicore* the parietal sends down a process which joins the alisphenoid. These bones join likewise in *Eotherium*. In *Desmostylus* the two bones are well separated by a process of the frontal, which extends backward and joins the squamosal. On each side of the parietal, about 20 mm. from the midline, is a low temporal ridge. From side to side the parietal is arched, although slightly flattened between the ridges just mentioned.

Each squamosal is a large bone which contributes to the formation of the side walls of the brain-case, partly incloses the auditory organ, forms a surface for the articulation of the lower jaw, and sends a great process forward to assist in forming the zygomatic arch. The suture formed with the parietal is 100 mm. long. The lower hinder angle forms a rough post-tympanic process, which joins the mastoid portion of the otic. The zygomatic process extends forward to a point 160 mm. in front of the rear of the squamosal, where it joins the malar. Unlike that of *Trichechus* and *Halicore*, this process extends backward on its upper edge to the outer end of the occipital ridge. The lower border of the process extends backward and inward to the bulla-like tympanic ridge. Between these two borders, or roots, of the zygomatic process is a large tympanic cavity. At the front of this cavity the process is 33 mm. high; at the rear of the malar bone, two-thirds of the length from the rear, it is 53 mm. high and 14 mm. thick. The glenoid fossa is quite different from that of either *Trichechus* or *Halicore*. In these genera the articular surface for the lower jaw is elevated (as seen with the palatal surface held upward) above the surrounding bone. In *Trichechus*, especially, there is a deep transverse groove behind this surface, and behind the groove is a ridge. In *Desmostylus* the articulatory surface is flat and on a level with the rest of the bone. It measures 39 mm. from side to side; 22 mm. from front to rear.

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[1] Die Säugetiere, p. 792.

The auditory organ is very different from that seen in *Trichechus* and *Halicore*. In the former there is an oval opening 74 mm. wide and 53 mm. long between the exoccipital and the alisphenoid, and this is occupied mostly by the otic bones. It is smaller in *Halicore*, but still large. In *Desmostylus* what corresponds to the same opening extends obliquely forward and inward a distance of about 60 mm. and fore and aft about 20 mm. Included in this opening is, outwardly, what is probably the stylomastoid foramen; mesially, the foramen lacerum posterius. In front of these openings, running obliquely forward and inward, is a ridge 50 mm. long, about 12 mm. high, and 7 mm. thick at the base. It is wedged in between the glenoid fossa and a part of the alisphenoid in front and the exoccipital behind. It evidently corresponds to the tympanic bulla of the ox. In the deep tympanic cavity the tympanic ring is probably not ankylosed to the surrounding bones, but the sutures can not be distinguished.

In *Trichechus* and *Halicore* there is a cleft between the exoccipital and the squamosal which is partly filled up by the mastoid portion of the petrous bone. In *Desmostylus* the mastoid portion is relatively much larger and forms a prominent portion of the hinder lower angle of the skull. Seen from behind it forms a strip of bone 60 mm. or more high and 28 mm. wide, tightly wedged in between the paroccipital and post-tympanic processes. Seen from below it passes between the processes nearly to the stylomastoid foramen. In a young musk-ox I find a very similarly disposed mastoid, but it is only 55 mm. high and 11 mm. wide.

As already stated the alisphenoid does not come into contact with the parietal. The pterygoid processes are feeble in comparison with those of *Trichechus*. They are thin—about 8 mm. or 10 mm. thick, and they descend from the level of the basisphenoid only about 20 mm. In a skull of *Trichechus* they descend a distance of about 44 mm. and are 18 mm. thick. Near the hinder border of the bone is seen the foramen ovale. Just behind this the alisphenoid sends backward a splint of bone against the front of the bulla-like ridge, much as is seen in the skull of a cow at hand. Anteriorly the alisphenoid joins the frontal above and the maxilla and the palatine below. The suture with the maxilla appears to be hidden in a deep fold behind the capsule of the hindermost tooth; and in this fold, too, are concealed the optic and other foramina.

The palatines are more extensively developed than in *Trichechus* and *Halicore*. They resemble the same bones in *Eotherium*. They extend forward to a line joining the front ends of the penultimate molars. Here, taken together, they have a width of 30 mm. Posteriorly the bones widen, so that at the front of the hinder nares they are 60 mm. wide, while at the middle of the mesopterygoid fossa the distance between their outer borders is 70 mm. As seen when the skull is turned with the palate upward, the hinder branches of the palatines overlap and conceal the edges of the pterygoid processes of the alisphenoid, extending backward nearly to the rear of the basisphenoid. The suture between the palatines and the maxillae are smooth and straight laterally, but in front they are very jagged.

On account of the advanced position of the external nares, the frontal bones are more normally developed than in probably any other sirenian. From their rear to a line joining their anterior ends is a distance of 148 mm. Posteriorly they fit into a broad notch between the parietals; in front they form a notch for the rear ends of the nasals. Their greatest breadth is at the supraorbital process, and here it is 110 mm. At this place they overlap the lachrymals. The hinder ends of the processes which join the squamosals are 97 mm. apart. These processes are 21 mm. wide and extend backward from their divergence from the body of the bone a distance of 37 mm. The lower border of each process joins the alisphenoid of its side, and the suture can be followed forward until it disappears in the fold between the capsule of the last molar and the body of the frontal. The anterior end of each frontal is truncated.

The nasals have the anterior end injured, but there is no reason to suppose that they terminate in front in any way different from that seen in Yoshiwara and Iwasaki's specimen. Quite certainly they ended in front in a sharp point a few millimeters behind the nasal opening. The length of each was close to 100 mm., the greatest width of the two combined is 30 mm. Posteriorly they are enclosed in a notch between the frontals; laterally they unite with the maxillae for a distance of 16 mm.; and for the rest of their length with the premaxillae. The relations of these bones are not greatly different from those of an ox, except that they do not come into contact with the lachrymals.

The lachrymal (pls. 56, 58, 7) is a very considerable bone in *Desmostylus*. It does not appear on the face, as in the Ungulata, but it forms the inner wall and the roof of the orbit. The position is as in the elephant, but the bone is far more developed than in the elephant. The sutures bounding its hinder half are not as distinct as desirable, but the length from the front to the rear is at least 50 mm. Over the orbit it forms the supraorbital process, but it is here covered over by the frontal. In the specimen described the frontal on the right side has been split off from the process so as to expose the part belonging to the lachrymal. This bone does not come into contact with the suborbital process of the malar, as it does in *Halicore*, but there intervenes between them a narrow strip of the maxilla. The lachrymal is imperforate.

The maxillae have lost a part of their anterior ends. In Yoshiwara and Iwasaki's figures these bones are represented as coming forward as far as the front of the nasal opening; hence in our specimen probably about 50 mm. of each bone is missing at the side of the snout. On the palatal surface, near the midline, is seen a fragment of the premaxilla and the premaxillo-maxillary suture. From this suture to the hinder end of the maxilla is a distance of 180 mm. In front of the orbit it rises to join the nasal for a distance of about 18 mm. Anteriorly this nasal process joins the premaxilla; posteriorly the frontal and lachrymal. At the front of the orbit the maxilla passes beneath the anterior process of the malar. Just how it ends at the anterior end of the zygomatic arch is not clear, inasmuch as the bone is injured here on both sides. On the underside of the arch, below the rear of the orbit, there appears to have been a downwardly directed process, similar to that which is seen in *Halicore* and *Trichechus*, descending from the lower border of the malar. The dimensions of this process can not be determined exactly, except that here the bone is about 5.5 mm. thick.

Beneath the shelf of bone under the orbit, formed by the malar and the maxilla, the bone is conspicuously excavated. Vertically the excavation reaches from the side of the snout to the alveolar border of the jaw; fore and aft, from the side of the snout to below the rear of the orbit. In the bottom of this excavation opens the infraorbital foramen. Seen from below, the maxillae meet in the midline by a straight suture along a low ridge; and they extend backward to join the palatines, as has been described. The palate along these bones is concave longitudinally as well as transversely. At the rear, at some distance in front of the palatine suture, is a pair of openings, the post-palatine foramina. The alveolar border on each side is narrow in front, but about half way back to the palatine border it begins to widen, to accommodate the teeth. At the rear this border is bounded inwardly by a strong ridge which articulates with the palatine.

The rear of the maxilla on each side forms a great capsule, in which is enclosed the developing hindermost molar. This protrudes upwardly into the front of the temporal fossa and almost into the rear of the orbit. It has a length of nearly 80 mm., a height of 53 mm., and a width of 48 mm.

The premaxillae are seen on the upper surface of the skull as a pair of lance-like processes, one at each side of the nasal opening, passing backward to become wedged in between the nasal and the ascending process of the maxilla. At the rear of the nasal opening each had a width of 30 mm. For our knowledge of the front part of these bones we must depend on the Japanese authors who have been already referred to. In their specimen the premaxillae formed the tip of the snout and extended back in each side of the nasal opening. From the front of the snout to the front of the nasal opening was a distance of 70 mm., from which fact we may conclude that the distance was about 35 mm. in *Desmostylus hesperus*. The amount missing in our specimen must be close to 75 mm. From the front to the rear of each premaxilla was then about 145 mm.

It is evident from Yoshiwara and Iwasaki's figures that the premaxillae, while retaining their width, thinned out in front to a transverse edge. They could hardly have been armed in front with teeth of any considerable size.

In the Oregon specimen the premaxillo-maxillary suture appears to be preserved on the palatal surface. Near the midline it turns back a distance of 20 mm. and ends at the midline. As the bone is injured at the midline, nothing can be determined regarding the anterior palatine foramina.

As already stated, Marsh based the genus *Demostylus* on teeth. He described them as being composed of a number of vertical columns closely pressed together, and in adult animals firmly united at their bases. He stated that in immature teeth the columns are nearly round and loosely united, but as they increase in size they press together and become more or less polygonal in cross section. These statements appear to be wholly correct. He says further that before being worn they have their summits smooth and convex, but after some use the center of each column presents a rounded elevation, such as is shown in his figure. This appears to be an error. The hindermost tooth of the Oregon specimen had only just come through the bone and had certainly not come into use; but the summits of the columns have exactly the structure described by Marsh (pl. 57, *23*). The three columns which he figured are certainly those of an unworn tooth.

As to the number of columns in each tooth Marsh was uncertain; but he thought that there were indications of at least twelve or fifteen. From what is at present known this conclusion is erroneous.

In none of the teeth figured by Yoshiwara and Iwasaka are there more than ten pillars, and not so many appear in any tooth of the specimen at hand.

As to the number of teeth of each kind we are not yet wholly certain. The Japanese authors were fortunate in having the anterior half of both rami of the lower jaw. On each side of this they found two straight, forwardly directed, tusk-like teeth, which they interpreted as the first and second incisors. The length was believed to be about 200 mm., and the diameter about 31.5 mm. Inasmuch as the lower jaw is missing in the Oregon specimen no comparisons can be made.

In the front part of the upper jaw the Japanese specimen presented, within the somewhat injured maxilla of the left side, a tooth resembling the tusk-like teeth of the lower jaw and, like them, directed forward; but it had not been extruded. The describers concluded that it was an incisor. However, this tooth appears to be inclosed principally in the maxilla, near the premaxillo-maxillary suture, and it is more probable that it was a canine. In *Prorastomus* there were well-developed canines above and below. In the upper jaw of *Eosiren*[1] there was a small canine and apparently small second and third incisors. There was, on each side, in the genus just mentioned, a large first incisor, as there is in *Halicore;* but it was at the end of the snout. In *Halicore* this tooth is wholly in the premaxillary. It seems most probable that the large upper tusk-like tooth of *Desmostylus* is a canine and that in the Japanese specimen it was destined to remain in the jaw, as the great first incisor of the female *Halicore* does. In the upper jaw of our specimen of *Desmostylus,* on the right side, there is present what seems to be the base of the upper tooth supposed to be a canine. All that is present lies behind the suture between the premaxilla and the maxilla, and it is badly eroded. In case the upper tusk-like tooth is a canine, it is probable that the hinder of the lower ones is also a canine. The other one is probably a third incisor, inasmuch as it is far removed from the midline of the front of the jaw.

Yoshiwara and Iwasaki found in the upper jaw, far behind the tusk, a tooth composed of four cylindrical pillars, varying in diameter. This tooth, about 22 mm. long and 24 mm. wide, was regarded by them as the second premolar; and there were reasons for believing that there was another front of it, pm^1?. Inasmuch as these teeth are immediately in front of a molar and there is a great space in front of them which might, in some ancestor at least, have been occupied by premolars, there seems to be little reason for not regarding them as pm^3 and pm^4; unless, indeed, as may have been the case in *Eotherium*[1] they are pm^4 and pm^5, or pm^5 and pm^6. Since *Desmostylus* is so primitive in other respects, the writer prefers to regard them as pm^3 and pm^4.

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[1] Andrews, Catalogue of the Tertiary Vertebrata of the Fayûm, Egypt, p. 203, pl. 20, fig. 1.

In the skull from Oregon there is present the base of a tooth which belongs to the hinder premolar (pl. 57, *21*). It is nearly circular in section, with a transverse diameter of 17 mm. and a longitudinal diameter slightly less. There appears to be no reason for supposing that it had more than a single root, except that the Japanese writers say that the teeth in their specimen were two-rooted in all cases. How many columns there were in this tooth it is impossible to say with certainty; but the appearances are that there were a large one on the inner side, a second large one in front and nearer the outer side, and two smaller ones on the outer side and toward the rear. This could not be greatly different from the tooth regarded by the Japanese authors as pm^2.

With the skull here described there was sent a tooth which probably belonged to another individual (pl. 58, figs. 5, 6). It is composed of four columns of equal size and these had undergone considerable wear. The diameter of the tooth is 20 mm. This tooth has a worn surface on a side of one of its columns where it had been in contact with another tooth. This was certainly on the hinder face of the tooth; and from the form of the tooth I conclude that it belonged on the left side, in case it was an upper tooth. It was probably the hindermost premolar.

Immediately in front of the hinder premolar is a socket for another premolar; as I suppose, for pm^3. This socket is 14 mm. long and 9 mm. wide. There is a corresponding one on the left side. Yoshiwara and Iwasaki found evidence in the wear of a lower tooth that there was a premolar in front of the upper one which they described. Just in front of the socket mentioned there is a little pit, about 3.5 mm. in diameter, from which a small tooth may have fallen before the death of this animal. Between this pit and the object which is supposed to be a canine there is no evidence of the presence of other teeth. For a distance of about 12 mm. in front of the pit mentioned the narrow alveolar border is uninjured, but the remainder has the border broken off.

Behind the supposed pm^4 there is the first molar (pl. 57, *22*). On the left side of the skull this is broken off close to the bone and even this is eroded; on the right side all the columns are broken off not far from their common base. As preserved, the length of the crown is 40 mm. and the width 28 mm.; but by measuring nearer the bone the length is only 35 mm.; the width 25 mm. The length and the width of the complete tooth must have exceeded these figures somewhat. There appear to have been present only five columns, two large ones in front, then two smaller ones in a transverse row, then behind and between these another. It is, however, possible that there was a column in front of and between the two first mentioned. No tooth of those described and figured by Yoshiwara and Iwasaki has the structure of this tooth. The corresponding one of their specimen had three columns in the first transverse row, two columns in each of two succeeding transverse rows, and in the rear a single column. This tooth had a length of 64 mm. and a width of 40 mm. Measured where longest the tooth, according to the authors' figure, had a length of 70 mm.

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[1] Andrews, Catalogue of the Tertiary Vertebrata of the Fayûm, Egpyt, p. 208.

In the figure of the Japanese specimen there is represented, in the rear of a large bony capsule, portions of three columns of an imperfectly developed tooth which the authors regarded as the second molar. It is evident that this corresponds to the tooth just at the point of eruption in the Oregon skull.

In the latter there were seen originally only the summits of four columns; in front a transverse row of two columns, a second row of two columns, and a single column behind all. Thinking that other columns might be concealed within the jaw, the writer proceeded to dig away a part of the base of the first molar, some bone, and the hard matrix within the cavity. As a result, three more columns were discovered in a transverse anterior row, making in all eight (pl. 57. *23*). Therefore this second molar agrees in structure with the first upper molar of the Japanese specimen. In the skull before me the summits of the median and inner of the three columns lean rather strongly backward. The outer column is considerably shorter than the others. These anterior columns are lodged partly above the rear of the crown of the first molar. The column which is extruded the farthest is the inner one of the second row. It has a diameter of 13 mm. a short distance above its summit. The unworn summits of all the columns show a thick ring of enamel and in the center of the pit a little elevation.

Whether or not a third molar might at a later time have been developed behind the one just appearing it is impossible to speak with certainty. Naturally, our specimen throws no light on the lower teeth. In the lower jaw of the Japanese specimen Yoshiwara and Iwasaki found two premolars and a molar. The premolars they, as in the upper jaw, called the first and second; but there are the same reasons for giving these a higher number that we have found in the case of the premolars of the upper jaw. The crown of the tooth which they called the first lower premolar had a length of 32 mm., a width of 20 mm., and a height of about 27 mm. It was composed of seven columns rather irregularly arranged. The second premolars had a crown whose length was 47 mm., width 32 mm., and height 25 mm. It was composed of seven columns. The front and middle transverse rows had two each; the hinder row three, of which one is small. It will be observed that the length of the crowns of these two premolars taken together amounts to 79 mm. Opposed to these in the upper jaw the Japanese investigators found but one premolar, having only four columns and a grinding surface about 23 mm. long. Because of the state of wear on the hinder lower premolar they assumed the presence of another upper premolar; and their conclusion may be said to be confirmed by the Oregon specimen. Nevertheless, this would not probably have more than doubled the length of the grinding surface of the upper premolars, making it about 46 mm., just enough to cover the hindermost lower premolar. So far as appears there was nothing to oppose the anterior lower premolar. Another rather remarkable thing is that the hindermost upper premolar was so small in comparison with the last lower one.

It occurred to me that possibly the tooth in the Japanese specimen which is regarded as the last lower premolar was really the first molar. The lengths of the grinding faces of the two teeth are not greatly different; and on that supposition the anterior premolar would be opposed by the two upper premolars. This view would involve the removal of the lower jaw backward a distance of 47 mm. The Japanese authors had already concluded that the tip of the upper jaw protruded beyond the lower about 40 mm. The two sums together would amount to 87 mm. As the distance from the front of the upper jaw to the front of the nasal opening is given as 70 mm., we would have the tip of the lower jaw about 17 mm. behind this opening. This does not seem probable. Moreover, the crown of the upper first molar has a height of 60 mm., while that of the lower tooth which we are assuming to work against it has the crown worn down to a height of 25 mm. This is not likely to have been true. I am at present unable to solve the problem presented.

The tooth regarded, and probably properly so, by Yoshiwara and Iwasaki as the first lower molar had a crown whose length is given as 64 mm., width as 40 mm., and height as 39 mm. It consists of three transverse rows each with two columns. It has the dimensions of the first upper molar and was therefore a worthy antagonist of it.

From Yoshiwara and Iwasaki's paper we learn that in their specimen the first upper molar had three columns in the front transverse row, while the corresponding lower molar had only two columns in each row. On the other hand, the last lower premolar had three columns in the hinder row, two each of the other two rows.

Through the kind offices of Mrs. McCornack, I have received for examination from Prof. Warren D. Smith, head of the geological department of the University of Oregon, the tooth which has been already mentioned as having been found at Yaquina Bay by Proessor Condon. Two views of this tooth are here presented (pl. 58, figs. 3, 4). The tooth is considerably worn and all but the base of the root is missing. The crown consists of eight columns, three in a transverse row at one end, a single column at the other end, and between these two rows of two columns each. I interpret this tooth as the second upper molar of the right side. It has quite exactly the size and the arrangement of the columns seen in the uncut second molar of the skull here described, except that the oblique line joining the centers of the columns of each row is directed differently. Excepting in size, the tooth resembles closely the upper first molar of the Japanese specimen. The front end of the tooth is concave from side to side and the polished surfaces on the free faces of the columns show that another tooth of considerable size abutted against it. But there is likewise a surface of wear near the base of the single column which is supposed to be at the rear of the tooth. If, therefore, I am right in identifying this tooth as the upper second molar, it must be concluded that a third molar was coming up at the rear of it.

The length of the tooth here described, taken at the middle of the width, is 51 mm.; the greatest width, 33 mm.; the height of the columns, 27 mm. The largest columns have a diameter of 16 mm. Those of the anterior row are pretty strongly curved, with the concavity toward the contiguous columns. In the valley between the various columns is seen a small quantity of cement. It is not unlikely that this supporting material was more abundant during life.

In his paper published in 1911, already referred to, Merriam figured a tooth which had been found near Coalingua, Fresno County. This tooth is nearly identical in form with the one just described, but it is slightly larger. The length is 56 mm.; the width, 40 mm. A considerable part of the root is retained. There is a single fang in front and a larger one (possibly subdivided) at the rear. The grinding surface is worn concave from front to rear and from side to side. Judging from the teeth of the Proboscidea, we might be led to regard this tooth as one of the lower jaw.

It seems to me that there are, between the Japanese specimen and that from Oregon, differences of specific importance. The most striking of these is found in the sizes of the two animals. The Japanese skull was about twice as long as the American. Here follows a table which shows certain common dimensions and their ratios, those of the Japanese specimen being taken as 100. The dimensions of the latter specimen have been taken mostly from Yoshiwara and Iwasaki's statements, but partly from their illustrations.

Measurements.

Dimensions taken.	Japanese.	Oregon.	Ratios.
	mm.	*mm.*	
Width across the snout at nasal opening	130	75	58
Height of skull behind orbits	160	105	66
From rear of nostril to rear of nasal bones	240	115	48
From rear of nostril to front of orbit	200	95	48
Distance between inner borders of first molars	110	65	59

While these measurements show a great difference in the sizes of the two specimens, the ratios indicate considerable differences of proportions. The variations observed can not be due to differences of age; for, as shown by the more advanced condition of the hindermost molar, the Oregon specimen was the older.

If now we take the distance from the rear of the nostril to the rear of the nasal bones as a measure and give it the value 100 we shall have the following table:

Ratios of measurements.

Dimensions compared.	Japanese skull.	Oregon skull.
Ratio of distance between rear of nostril and rear of nasals to itself	100	100
Ratio of width across snout to distance between nostril and rear of nasals	54	65
Ratio of height of skull to distance between nostril and rear of nasals	67	91
Ratio of distance between rear of nostril and front of orbit to distance between nostril and rear of nasals	83	83
Ratio of distance between first molars to distance between nostril and rear of nasals	57	46

From these estimates it appears that relatively to the distance from the nostril to the rear of the nasals, *D. hesperus* has a wider snout, a higher skull, and a narrower palate between the last molars than the Japanese specimen had.

Quite as important as regards the relationships of the two animals is the structure of the first molar. There seems to have been in the Oregon specimen only two columns in the anterior row, although it is possible that a median one sprouted off from the base between the two recognized; but behind this row is only one transverse row of two columns; whereas, in the Japanese specimen, there were two transverse rows of two columns each.

The Oregon animal can hardly belong to anything else than the species called by Marsh *Desmostylus hesperus.* Under the circumstances it is the Japanese species which must receive a name. Hence, in honor of my friend Shozaburo Watase, Professor of Zoology in the Imperial University of Tokio, I call it *Desmostylus watasei.*

The following diagnoses may be proposed:

DESMOSTYLUS Marsh.

A Miocene genus of the Sirenia, exhibiting in its skull many primitive characters. Snout little deflected, nasal opening small and far in advance of the orbits. Nasal bone long and narrow. Brain case broad and rounded above; the temporal ridges feebly developed. Upper jaw with a pair of tusklike teeth, probably canines. Lower jaw with two pairs of tusks. Molars and some of the premolars composed each of high, closely appressed columns, varying in number.

Species of Desmostylus.

1. A species of moderate size, apparently with somewhat broader snout, higher skull, and narrower palate posteriorly. First upper molar apparently with five columns. American...*hesperus*.
2. A large species, with a snout apparently narrower, a frontal region lower, palate posteriorly wider, and the first upper molar with eight columns. Japanese. *watasei*.

EXPLANATION OF PLATES.

Explanation of numerals: 1, supraoccipital; 2, parietal; 3, frontal; 4, nasal; 5, premaxillary; 6, maxillary; 7, lachrymal; 8, squamosal; 9, zygoma; 10, jugal; 11, capsule for second molar; 12, nasal opening; 13, exoccipital condyle; 14, basioccipital; 15, basisphenoid; 16, adventitious bone; 17, mastoid; 18, palatine; 19, tympanic bulla; 20, supposed third premolar; 21, fourth premolar; 22, first molar; 23, second molar; 24, foramen lacerum posterius; 25, condylar foramen; 26, stylomastoid foramen; 27, tympanic cavity; 28, infraorbital foramen; 29, exoccipital; 30, paroccipital process.

PLATE 56.

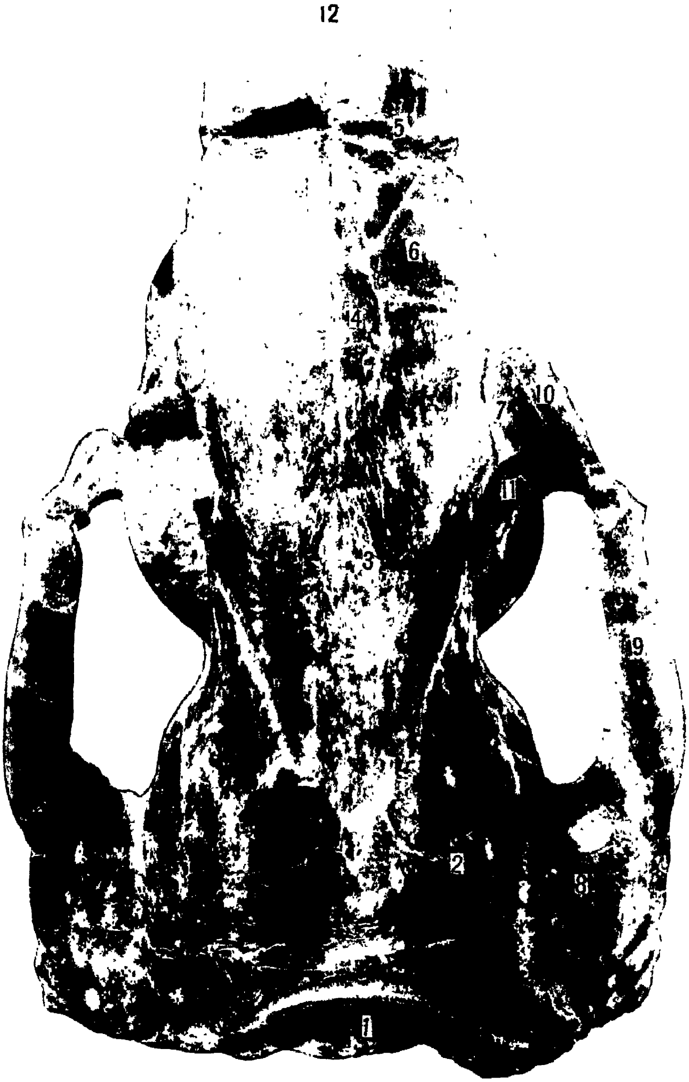
Desmostylus hesperus Marsh. Skull seen from above. × ⅖.

PLATE 57.

Desmostylus hesperus Marsh. Skull seen from below. × ⅖.

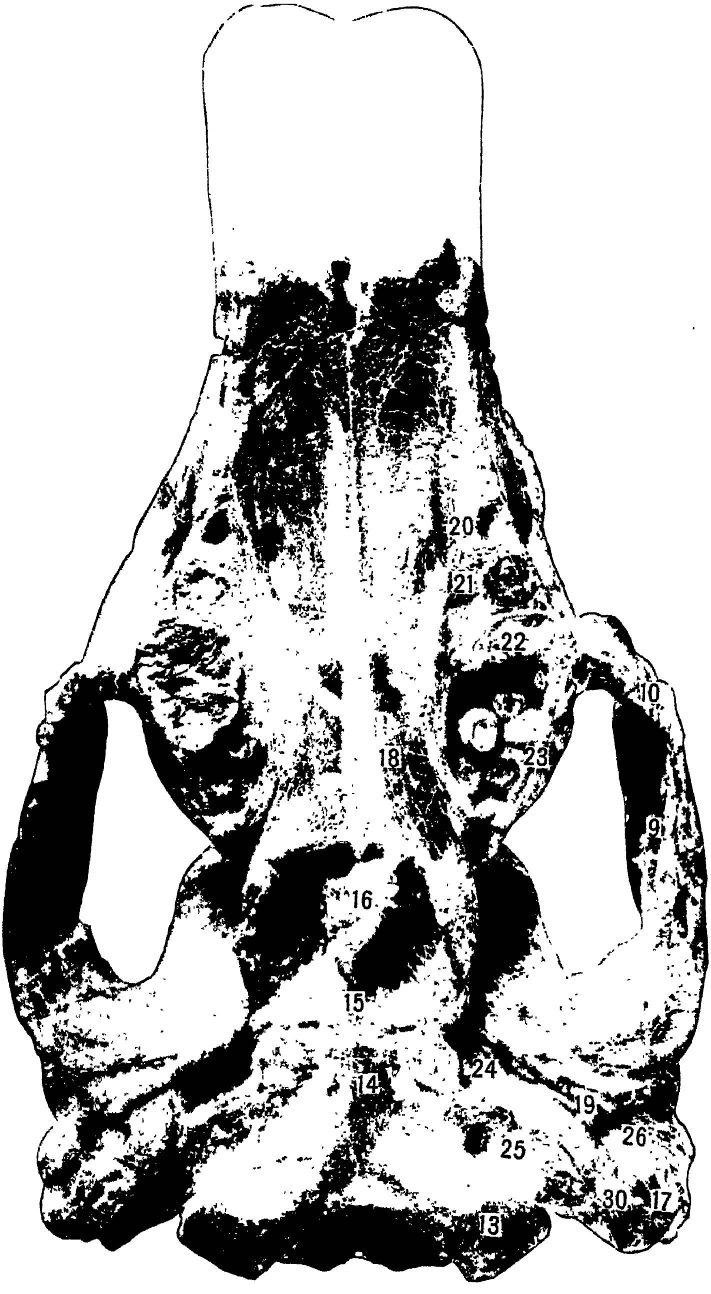
PLATE 58.

Desmostylus hesperus Marsh.
Figs. 1, 2. Skull. × ⅖.
  1. Seen from the left side.
  2. Seen from behind.
Figs. 3, 4. Supposed upper right second molar. × 1.
  3. Showing grinding surfaces. Anterior end directed upward.
  4. Seen from the left side. Anterior end directed to the left.
Figs. 5, 6. Supposed upper fourth premolar. × 1.
  5. View of grinding surface.
  6. View of tooth from the rear.



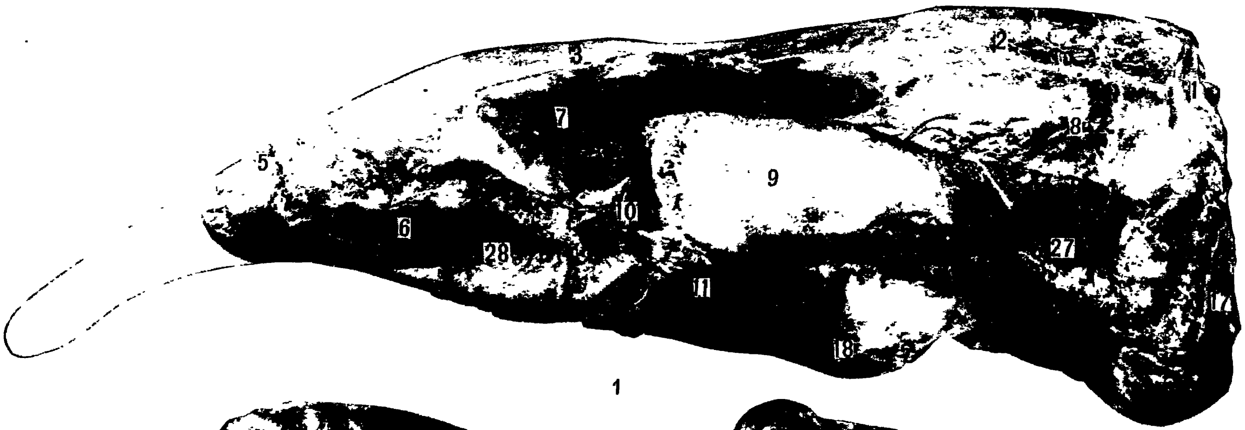
SKULL OF DESMOSTYLUS HESPERUS MARSH.

FOR EXPLANATION OF PLATE SEE PAGE 397.



SKULL OF DESMOSTYLUS HESPERUS MARSH.

FOR EXPLANATION OF PLATE SEE PAGE 397.



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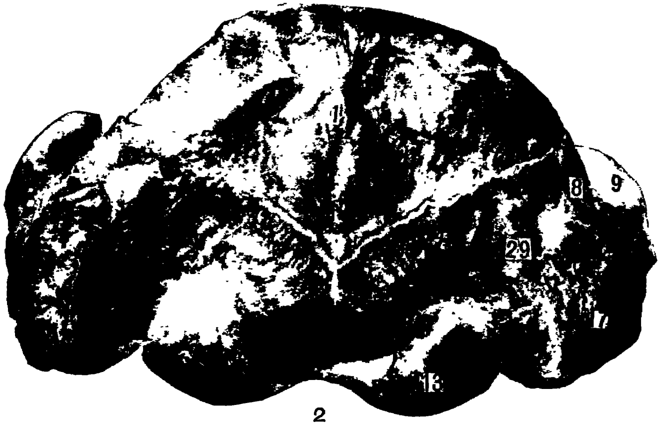

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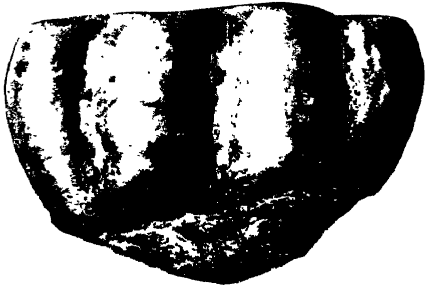

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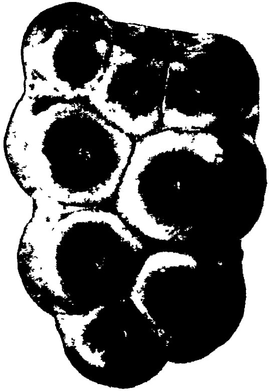

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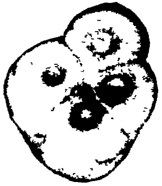

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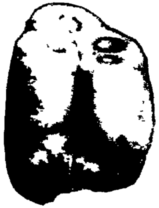

6

SKULL AND TEETH OF DESMOSTYLUS HESPERUS MARSH.

FOR EXPLANATION OF PLATE SEE PAGE 397.

EPERETMUS, A NEW GENUS OF TRACHOMEDUSAE.

By HENRY B. BIGELOW.

Of the Museum of Comparative Zoology, Cambridge, Massachusetts.

Among a miscellaneous collection of Medusae loaned me for study by the United States National Museum is a specimen which I at first took for an *Olindias*, but which proves, on closer examination, to represent an undescribed, though related, genus.

In previous papers (1909, 1912, 1913) I have followed Browne (1904) and Maas (1905) in using the family name Petasidae for the assemblage of closely related genera, whose best-known members are *Gonionemus* and *Olindias*. But with the passage of time it becomes less and less likely that Haeckel's (1879) genus *Petasus* (on which the family name Petasidae is based) will ever be connected with any actual Medusa; hence it is increasingly probable that the name Petasidae will have to be abandoned to be replaced by Olindiidae (*sensu* Browne, 1905). Browne and I have divided the family into two subfamilies, Olindiinae and Petasinae, the former for genera in which the otocyst clubs are inclosed in a capsule (which, itself, may either stand free on the bell margin or lie inclosed in the gelatinous substance of the exumbrella or velum), or stand free on the bell margin. Mayer (1910) and Goto (1903) have used a different criterion, namely, the presence or absence of tentacular suckers, resulting in a totally different alignment of genera. But throughout the medusan series the structure of otocyst is much more significant than of tentacle. And that their system is the more artificial of the two, neither of which can, perhaps, claim to be a truly natural one, is shown by the fact that it throws into different subfamilies genera as closely related as *Gossea* and *Gonionemus*. Up to 1912 the subfamily Petasinae, as defined by Browne and me, contained only Haeckel's apocryphal genera *Petasus*, *Dipetasus*, *Petasata*, and *Petachnum*, none of which have been seen since first described. But in that year a new genus, *Nauarchus*, was added to the list, thanks to its free otocyst clubs (Bigelow, 1912). All the other genera belong to the Olindiinae.

The various Olindiinae are obviously closely related to one another, but the characters which separate them are remarkably precise for a medusan family, the only confusion being in the case of genera insufficiently studied. They all agree in the structure, though not in the location, of the otocysts, and in the fact that the primary tentacles, which of course arise from the bell margin, turn upward as they grow older, lying in furrows of the exumbrella, so that they emerge from the bell at some height above the margin. But these tentacles may or may not bear suckers, or terminal knobs; there may or may not be a second series of marginal tentacles, or the latter may be represented by clubs; there may or may not be centripetal canals between the radials; the otocyst capsules may be free; they may be embedded in the exumbrella, or in the velum; the tentacles may be in continuous series or they may be grouped; and there may be either 4 or 6 metameres. The presence or absence of secondary tentacles and of centripetal canals, of course, allow four possible combinations of which three were previously known, while the new genus *Eperetmus*, here described, exemplifies the fourth.

The combinations of characters as found in the various genera may be illustrated by the following tabular view (which is, of course, purely artificial):

a^{1}. With primary tentacles only. With 4 metameres.
  b^{1}. Tentacles in a simple series.
   c^{1}. No centripetal canals.
   d^{1}. Otocyst capsules free.......... *Aglauropsis*.
   d^{2}. Otocyst capsules embedded in the velum.......... *Craspedacusta*.
   c^{2}. With centripetal canals.......... *Eperetmus*, new genus.
  b^{2}. Tentacles in groups.
   No centripetal canals.......... *Gossea*.
a^{2}. With primary tentacles, and secondary marginal clubs.
   With 4 metameres.
  b^{1}. No centripetal canals. Tentacles with suckers.......... *Gonionemus*.
  b^{2}. With centripetal canals. Tentacles without suckers (?).......... *Maeotias*.
a^{3}. With both primary and secondary tentacles, the former with suckers.
  b^{1}. With 4 metameres.
   c^{1}. No centripetal canals.
   d^{1}. 4 primary tentacles only.......... *Vallentinia*.
   d^{2}. Many primary tentacles.......... *Cubaia*.
   c^{2}. With centripetal canals.......... *Olindias*.
  b^{2}. With 6 metameres.
   With centripetal canals.......... *Olindioides*.

Six of these genera, *Craspedacusta*, *Gossea*, *Gonionemus*, *Cubaia*, *Olindias*, and *Olindioides*, are well known anatomically. The remaining three demand further research. One at least of them (*Vallentinia*) may finally prove to be a young stage of some other. There is no possibility, however, that this can be true of the new genus *Eperetmus*, for it is separated from most of its family relatives by positive, not negative characters, the presence of centripetal canals distinguishing it from *Aglauropsis*, *Craspedacusta*, *Gossea*, *Gonionemus*, and

Cubaia (*Vallentinia?*); the structure of the tips of the tentacles from *Olindias* and its close ally *Olindioides*. Its closest relative is apparently the genus *Maeotias* of Ostroumoff. Unfortunately, the description and figures of the latter (Ostroümoff, 1896) are not as detailed as could be wished, the structure of the tentacle tips being doubtful. But, apart from this point, *Maeotias*, like *Gonionemus*, is characterized by the presence of numerous marginal tentacular clubs, homologous with the marginal (secondary) tentacles of *Olindias* and *Olindioides*, structures entirely lacking in *Eperetmus*. And inasmuch as our specimen of the latter is apparently sexually mature, we can not suppose they would appear at a later stage. Another difference between *Eperetmus* and *Maeotias*, which may be equally important, is that whereas the older tentacles of the former emerge from the bell at a considerable height above the margin, the entodermal tentacular roots of the latter are so short that the point of emergence of the tentacles from the exumbrella is hardly appreciably above the margin. Furthermore, the otocyst capsules offer another precise differentiation between the two genera, being free in the latter, inclosed in the jelly in the former.

EPERETMUS TYPUS, new species.

Plate 59, figs. 1–8.

Albatross Station 4754; Oct. 4, 1905; lat. 55° 03′ N.; long. 131° 08′ W.; about 2 miles off Mary Island, southern Alaska; one specimen, 15 mm. in diameter, in good condition: type; Cat. No. 36301, U. S. National Museum.

Fortunately the unique specimen is in good enough condition to show all its important anatomical characters. The bell is saucer-shaped; in the preserved state (formalin) only about one-third as high as broad; the exumbrella thickly studded with minute conical prominences (fig. 2), which recall the surface roughness of *Aurelia* and some other Scyphomedusae. The velum is broad and muscular as in most related genera. The manubrium is cylindrical, hangs slightly below the bell-opening, and is seated on a short, broad peduncle (fig. 1, 4), as in *Gossea* and in *Olindias*. The lip (fig. 1) is cruciform, crenulated, and its margin thickly studded with spherical nematocyst knobs, which, being of various sizes, are probably in constant process of formation with the general growth of the Medusa (fig. 5). In all the other members of the subfamily which I have studied, i. e., *Gonionemus murbachii*, *G. vertens*, and *G. suvaensis*, *Gossea brachymera*, *Cubaia geophila*, *Olindias singularis*, *O. phosphorica*, and *Olindioides formosa*, the edge of the lip is smooth, though it may be folded. The radial, circular, and centripetal canals are notably broad and flat. Of the latter there are 4, 4, 4, and 5 in the respective quadrants, one interradial, two adradials, and one or two subradials in each quadrant. And their respective lengths, the former longest, the latter shortest, show that they are developed in that relative order. The interradials reach hardly half way from margin to apex (fig. 1), i. e., are relatively shorter than in *Olindias* or *Olindioides;* but perhaps they had not reached their final development.

The gonads occupy most of the length of the radial canals, leaving only short proximal and distal portions bare (fig. 4). In the one specimen they are simple, narrow folds hanging vertical from the oral sides of the canals, folded in a slightly wavy fashion, i. e., much as in half grown *Gonionemus murbachii* and *G. vertens,* without any trace of the papilliform processes so characteristic of *Olindias.*

The structure and location of the marginal organs, i. e., tentacles and otocysts, is as follows. As pointed out above, the tentacles are all of one kind, corresponding both in structure and in location to the primary tentacles of *Olindias;* and not only are there no velar tentacles; but even the marginal tentacular bulbs, so characteristic of *Gonionemus,* are likewise lacking. The total number of tentacles is 107, i. e., 28, 22, 24, and 29 in each quadrant, besides the four radials, of various sizes, and evidently of various ages. The four radials are largest; next in size are the four interradials, situated opposite the four interradial centripetal canals; next the eight adradials, corresponding to the eight adradial canals. In each quadrant there are one or two other large tentacles (opposite the subradial canals); and a considerable number of small ones, showing every stage in development from mere knobs to fully formed organs. Evidently the order of development for tentacles, as for canals, is radial, interradial, adradial, followed by subradials in irregular succession. The very youngest tentacles stand freely on the bell margin, pointing downward. But as they grow older (as illustrated by tentacles of successive sizes) they turn upward against the bell (fig. 2), and come to lie in grooves in the exumbrella. In the case of the largest tentacles these grooves are very deep (fig. 3), but they are all open, the jelly never closing over the root of the tentacle; and the oldest tentacles are so large that probably this is the final state.

There is a thick, opaque kidney-shaped nematocyst pad (fig. 2) associated with each large tentacle, lining the distal end of the groove in which it lies; itself forming a groove roughly triangular in cross section, and continuous both with the exumbrella and with the ectoderm of the oral face of the base of the tentacle (fig. 3). These pads vary in size with the size and age of the tentacles to which they belong, and are foreshadowed in the very youngest, which project free from the margin, by a thickening of the ectoderm at the base (fig. 2). The oldest tentacles emerge from the surface of the bell at about one-fifth the distance from the margin to apex; the younger ones successively lower and lower down. The tentacles are soft and flexible, the outer part of the older ones ringed with nematocyst ridges (fig. 6, 7). Few, if any, of the latter form complete rings; but no definite zone is free from them, a character in which the tentacles agree with the primary, but not the secondary, tentacles of *Olindias*, and with the tentacles of *Gonionemus*. The basal half of the large tentacles is smooth. In the young tentacles the smooth portion is relatively shorter; in the youngest the whole length is ringed with nematocyst ridges. The tips of all the tentacles, young and old, bear spherical knobs composed of closely crowned nematocysts, radially arranged; a termination very different from the suckers on the primary tentacles of *Olindias*, but suggesting the terminal knobs of the secondary tentacles of that genus; and practically indistinguishable from the tips of the tentacles in *Nauarchus* and *Gossea*.

The otocysts alternate roughly with the tentacles (fig. 2) instead of lying close to them, as in *Olindias*, and are about as numerous, i. e., a total of about 160; like the tentacles, they show various stages in development from newly formed to adult. Structurally the sense organs closely resemble those of *Olindias* and *Olindioides* (Gôto 1903); each consisting of an otolith, apparently enclosed by a thin protoplasmic layer, situated on a short protoplasmic stalk containing nuclei, but without visible cell walls. The organ is enclosed in a thin walled capsule, situated in close contact with the outer edge of the aboral wall of the circular canal, the whole deeply imbedded in, and entirely enclosed by the gelatinous substance of the bell. The position of the otocyst and its relation to the tentacle root, nerve ring, and circular canal is shown by a radial section through the disk (fig. 8). The otocysts differ from those of *Olindias*, in invariably having one otolith only, as seems to be the case in *Olindioides* also.

Color.—In the preserved state the nematocyst pads at the base of the large tentacles, the manubrium, and gonads are pale, but opaque yellow; otherwise the specimen is colorless.

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EXPLANATION OF PLATE 59

Fig. 1. *Eperetmus typus;* aboral view of one quadrant of the type-specimen, to show tentacles, canal system, and manubrium.

2. Aboral view of a segment of the marginal zone, to show otocysts (*O*), and young (T^1) and old (T^2) tentacles. (*N*), nematocyst pad; (*V*), velum.

3. Dissection of the marginal part of the bell, to show the exumbral furrows (*F*), nematocyst pads (*N*) and old and young tentacles (T^2, T^1) in cross section.

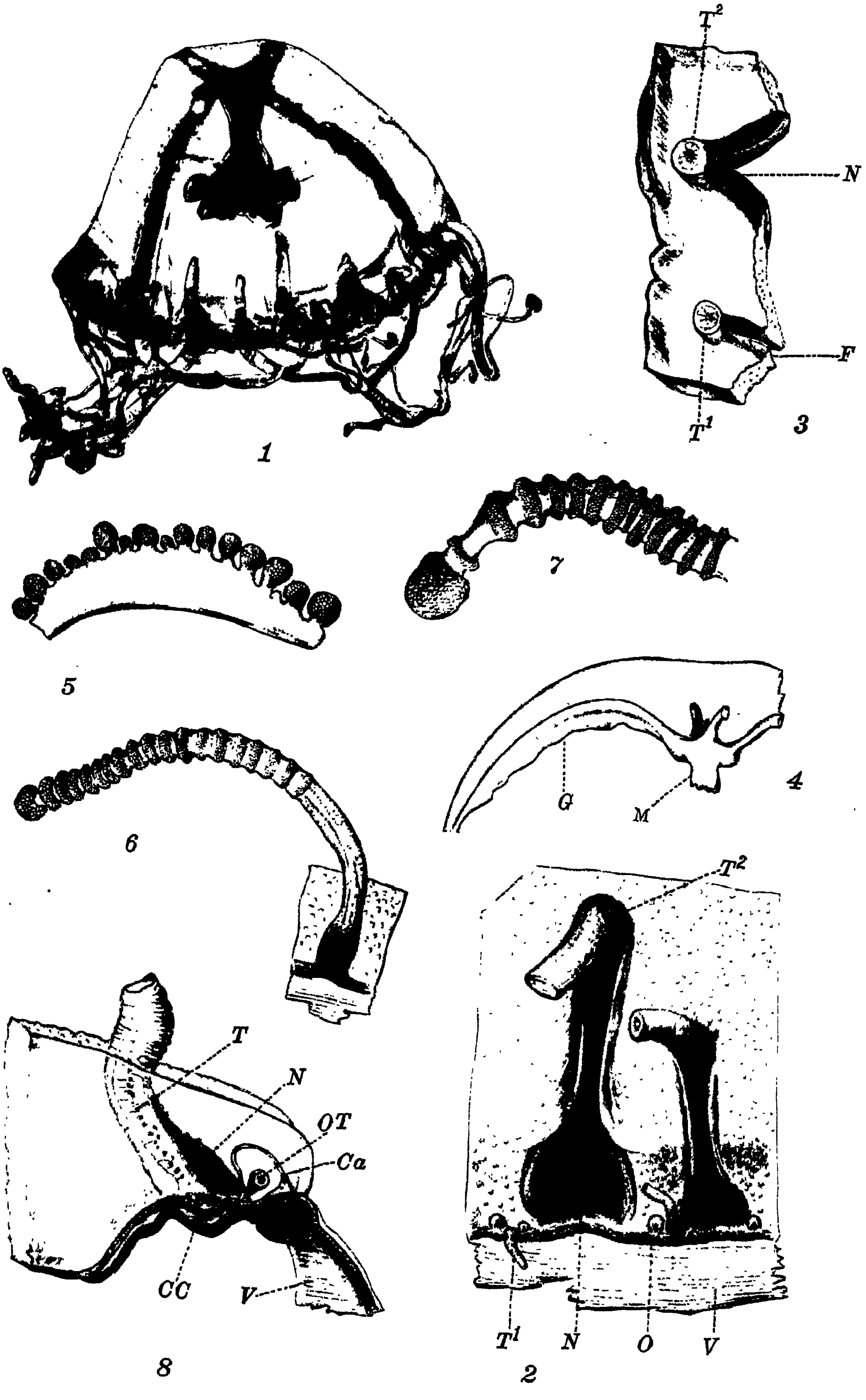
4. Radial section of bell, showing gonad (*G*) and base of manubrium (*M*).

5. Part of the margin of the lip.

6. A half-grown tentacle.

7. Tip of adult tentacle, showing nematocyst rings and terminal nematocyst knob.

8. Radial dissection of margin seen somewhat obliquely, to show position of the otocyst. (*T.*), entodermal core of half-grown tentacle; (*N*), nematocyst pad of same; (*C C*), circular canal; (*Ca*), capsule of otocyst; (*O T*), otolith; (*V*), velum.



Eperetmus, a New Genus of Trachomedusae.

NEW NEOTROPICAL MUSCOID FLIES.

By Charles H. T. Townsend,
Custodian of Muscoid Diptera, United States National Museum.

The writer's publications on the Neotropical muscoid fauna date back a quarter of a century. Previous to 1909 his most important papers on this subject were three in number.[1] Since that time, during nearly five year's residence in Peru, he made considerable muscoid collections, which have been deposited in the United States National Museum. The study of these and some other neotropical material has resulted so far in the publication of nine principal papers.[2] The present paper is in continuation of the publication of the results of identifying the Peruvian collections, with the inclusion of a few other neotropical forms.

It will be noted that certain changes in family names are here inaugurated. These have been made in conformity to the priority principle, the family taking its name from the earliest genus belonging thereto.

Family CALIRRHOIDAE.

PARAMYOCERA, new genus.

Genotype.—Paramyocera discalis, new species.

Intermediate between *Myocera* and *Scotiptera*, differing from former chiefly in possessing discal abdominal macrochaetae, and from latter in profile of occiput being vertical and not sloped forward inferiorly.

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[2] Descriptions of new genera and species of muscoid flies from the Andean and Pacific coast regions of South America, Proc. U. S. Nat. Mus., vol. 43, 1912, pp. 301–367. On the tribe Dejeaniini of the muscoid family Hystriciidae with five new genera, Psyche, vol. 20, 1913, pp. 102–106. New muscoid flies mainly Hystriciidae and Pyrrhosiinae from the Andean montanya, Insec. Inscit. Menstr., 78 pp. in ten parts: 1, pp. 144–148, vol. 1, 1913; 2, pp. 10–16; 3, pp. 29–32; 4, pp. 42–48; 5, pp. 81–96; 6, pp. 123–128; 7, pp. 133–144; 8, pp. 153–160; 9, pp. 169–176; 10, pp. 183–187, vol. 2, 1914. New Masiceratidae and Dexiidae from South America, Journ. New York Ent. Soc., vol. 23, 1915, pp. 61–68. An acalyptrate genus of Muscoidea—A polistiform genus of muscoid flies—A genus of hystriciine flies with white maggots, Insec. Inscit. Menstr., vol. 3, 1915, pp. 41, 43–46. New Andean spallanzaniine flies—New Peruvian hystriciine flies, Insec. Inscit. Menstr., vol. 3, 1915, pp. 63–76.

Proceedings U. S. National Museum, Vol. 49—No. 2115.

Male with extremely long claws, often nearly one and one-half times the elongate last tarsal joint; those of female much shorter than last tarsal joint. Male with two or three pairs of median discal macrochaetae on intermediate abdominal segments, an irregular discal row on third, and two discal rows on fourth. Female with one or two median discal pairs on second to fourth segments, no discal row nor approach to same on third, one discal row more or less pronounced on fourth. Frontals reaching only to root of antennae. Proclinate ocellar pair, postocellar pair, postvertical pair; ocellars stronger, others nearly equal. Third antennal joint about twice as long as second or somewhat less. Outer verticals much reduced in male, only half as long as inner verticals in female. Front of male at narrowest nearly twice width of ocellar area. Frontalia of male much narrower than those of female, narrowing posteriorly. Male without fronto-orbitals. Female with two strong proclinate outer or middle fronto-orbitals, and one inner or upper divaricate orbital. Female front at vertex as wide as one eye, the face evenly widening therefrom. Cheeks of female fully two-thirds eye-height, those of male about one-half eye-height.

PARAMYOCERA DISCALIS, new species.

Length of body, 10 to 11.5 mm.; of wing, 8.5 to 10 mm. One male and one female, Rio Rimac bottoms near Lima, Peru, December 17, 1912, on foliage; five males, Chosica, Peru, 2,800 feet, April 21, 1914, on foliage in brakes along Rio Rimac (Townsend).

Head, thorax, and scutellum ashy to silvery pollinose. Cheek grooves brownish-rufous. Frontalia rufous-brown. Antennae rufous, third joint usually blackish on apical half. Palpi light rufous to fulvous. A brassy tinge to pollen of head and pleurae. Five rather ill-defined vittae on thorax, the outer ones broad and interrupted, the middle one narrow; the other two sublinear and of distinct type, better defined. Scutellum varying from wholly blackish to almost wholly rufotestaceous, normally broadly blackish on base. Abdomen fulvorufous, with very broad black median vitta of equal width, thickly silvery-white pollinose over all. Legs blackish, tibiae dark rufous, sometimes tibiae and most of femora pale rufous. Wings faintly smoky-yellowish. Tegulae watery-tawny.

Holotype.—Cat. No. 19428, U.S.N.M., male, Lima. Allotype, female, TD 4105. Paratypes include male, TD 4234.

PUNACLISTA, new genus.

Genotype.—*Punaclista setosa,* new species.

Allied to *Brachicoma,* from which it may be distinguished by the following characters: Parafacials with a row of strong macrochaetae extending diagonally from root of antennae to lower border of eye. Frontals stopping at root of antennae. Arista thickened only at base, not pubescent. Male front narrowed on posterior half almost to width of ocellar area. The usual two vertical bristles present in female, but male lacks the outer one while the inner one is weak, latter being little stronger than the proclinate ocellars. Female with five outer fronto-orbitals on each side, the posterior one or two being divergent rather than proclinate. One reclinate upper or inner fronto-orbital in female, none in male. Palpi curved, filiform. Proboscis short and stout. Front very long, peristomal profile shorter but still long, face but little more than half as long as front. Facialia bare. Eyes bare. Cheeks rather less than half eye-height in both sexes. Third antennal joint but little longer than second in both sexes. Male with median marginal pair of bristles on first abdominal segment, female without; second segment in both sexes with median submarginal pair; third segment with median discal pair and no median marginal pair, with about four lateral marginal and subdiscal or discal ones; anal segment with anterior discal, middle discal, and posterior discal or submarginal in at least three transverse rows in female, more in male. Macrochaetae all strong in female, the frontals and abdominals weaker in male. Scutellum with two strong lateral pairs, and a shorter apical strongly decussate pair. Wings rather broad, extending beyond abdomen. Costal spine extremely long, more than twice as long as small crossvein. All tarsi of female rather widened and flattened, especially front and middle ones. The tarsal joints in male are rather wide, but less so than in female. Hind tibiae with unequal bristles. Male claws very long, microscopically short-bristled on inner aspect.

PUNACLISTA SETOSA, new species.

Length of body, 6.5 to 9 mm.; of wing, 5 to 7 mm. Four males and 10 females, March 6 and 7, 1913; and 7 males and 19 females, May 7, 1914, Oroya, Peru, over 12,000 feet, on bunch grass in Rio Mantaro valley bottom (Townsend).

Black. Parafrontals and parafacials silvery-white pollinose, changing to blackish with incidence of light. Clypeus silvery-cream color. Epistoma and cheeks with faint bloom. Occiput, pleurae, mesoscutum, and scutellum shining, with faint bloom. Thoracic vittae very indistinct, only the beginnings of two narrow median ones showing in front. Abdomen shining, with metallic greenish luster, without bloom. Legs black. Wings subhyaline, grayish, lightly smoky on costal to marginal cells, light yellowish on basal cells. Tegulae white, margins yellowish-tawny.

Holotype.—Cat. No. 19429, U.S.N.M., female, Allotype, male. Paratypes include TD 4120, female.

Family MILTOGRAMMIDAE.

DOLICHAMOBIA, new genus.

Genotype.—*Dolichamobia auromaculata*, new species.

Differs from *Amobia* as follows: Frontal profile subhorizontal, front greatly produced; parafacials at root of antennae almost as wide as eye; the head elongated as characteristic of so many high Andean forms, length of head at root of antennae being greater, however, than at vibrissae. Fronto-orbitals in male very long and strong. Postverticals about as long as ocellars. Male claws strongly elongate; all tarsal joints strongly double-spined apically. No costal spine.

DOLICHAMOBIA AUROMACULATA, new species.

Length of body, 8mm. (abdomen flexed); of wing, 7.75 mm. One male, Oroya, Peru, over 12,000 feet, Rio Mantaro valley bottom, March 7, 1913 (Townsend).

Black, lightly silvery-white pollinose, with pronounced gold maculation. The gold consists of large arcuate triangle marking parafacial sclerite on each side, bordered above with silvery; narrow occipito-orbits, interrupted by black spot below middle; outer surface of all coxae, inferior base of middle femora; tripartite subhumeral spot just below spiracle; three pleural spots on sternopleura, mesopleura, and pteropleura, the last smallest; broad irregular vitta from humerus to wing-root, and small spot inside front end of same; twin spot on median line immediately in front of suture, and pair small spots in middle of disk of postsutural mesoscutum; pair of larger spots in middle on hind margin of postsutural mesoscutum, continued on scutellum; a fleck on each side of mesoscutal border halfway between scutellum and wing-root; four basal spots each on second and third abdominal segments, the outer ones large and extending on venter to near middle; two ventral spots on first segment; whole anal segment except very narrow sublinear median vitta on dorsum; also very faint spot on hypopleural-bristle area, postscutellum with transverse marking, and spot on epistoma between vibrissal angles. The dorsal gold is laid on silvery-white, or edged with same. Three silvery-white vittae showing on thorax in front of suture, five showing faintly behind suture. Femora with gray bloom. Wings clear, tawny at base. Tegulae golden-whitish, margins yellow.

Holotype.—Cat. No. 19430, U.S.N.M.

Family SARCOPHAGIDAE.

PUNASARCOPHAGA, new genus.

Genotype.—*Punasarcophaga auromaculata*, new species.

Differs from *Sarcophaga* as follows: Male only described. Head more elongate, fully three-fourths as long as greatest or occipital height; plane of parafacials projected obliquely forward; parafacials fully two-fifths eye-width, quite evenly clothed with hairs scarcely longer than those of parafrontals. Frontal bristles reaching only to base of second antennal joint, the next to front bristle being exactly opposite root of antennae. Arista short-plumose on the enlarged basal half, the upper hairs slightly longer than the lower. One reclinate upper fronto-orbital in male. One pair of ocellars. Postverticals nearly as long as ocellars. Inner verticals strong, outer verticals weak and slightly or hardly differentiated from the occipito-orbital fringe. Occipitocentrals more or less approximating the postverticals in length. Front of male narrowed before vertex to width of space between vibrissae, nearly twice as wide at base of antennae. Epistoma practically cut off, only very slightly prominent or not at all so, extending well below vibrissae. Length of head at vibrissal angles about same as at root of antennae; facial profile a little shorter than occipital, the frontal profile slightly sloping downward anteriorly. Three sternopleurals and four postsuturals; one postacrostichal, two or three preacrostichals; three dorsocentrals before suture. A discal pair of scutellar bristles. A more or less developed marginal row of short macrochaetae on third abdominal segment, marginal row of fourth segment strong. Ventral plates two to four overlapping lateral segmental sclerites. Ventral plate five cleft, the keellike inferior edges of the two sections parallel and densely set with very short spines. Claws of male extremely long. Third vein bristly over halfway to small crossvein.

PUNASARCOPHAGA AUROMACULATA, new species.

Length of body, 7 to 9 mm.; of wing, 6 to 8 mm. Six males, Oroya, Peru, over 12,000 feet, Rio Mantaro valley bottom, March 7, 1913 (Townsend).

Blackish, silvery pollinose, with gold maculation. Coloration plan of the puna or high Andean sarcophagids, but with much less gold than *Dolichamobia auromaculata.* Lacks entirely the pleural, coxal and femoral gold spots; bears a large spot on each cheek, broad lateral border-vitta of presutural mesoscutum extending to wing-root, and spots on sides of abdominal segments one to four. Parafrontals and parafacials wholly light golden in one continuous area. There is a faint golden tinge to inside of median silvery pair of mesoscutal vittae. The tergum of abdomen is marmorate silvery with faint golden reflections and blackish median vitta. Venter golden only on edges, rest obscurely silvery pollinose. Wing bases and tegulae dull yellow. Hypopygium rufous, fifth segment golden. Two heavy silvery-gray median vittae on thorax extending over scutellum, and two narrower silvery ones outside them behind suture, leaving three strong black vittae, besides an irregular outer black border to mesoscutum. Palpi black. Antennae and frontalia black; clypeus faintly silvery, with more or less of a gold sheen. Third antennal joint one and one-half times to hardly twice the length of second.

Holotype.—Cat. No. 19431, U.S.N.M.

PUNAPHYTO, new genus.

Genotype.—*Punaphyto tridens*, new species.

Differs from *Sarcodexia* as follows: Male only described. Front at vertex a little wider than eye, widening very slightly anteriorly, face widening very slightly from same. Frontalia occupying almost or quite one-half of frontal width. Two small proclinate outer frontoorbitals in male. Heavy strong almost exactly divaricate ocellar pair. Row of fine hairs extending from parafrontals over parafacials to cheeks. Four or five facio-orbitals in close row near lower border of eyes and in line with the fine hair row, the lower two or three strong. Arista very short-hairy on a little over the basal half. Proboscis below geniculation about as long as antennae, stout, thick, corneous, hardly more than four times as long as thick, rather pointed at tip, the labella small. Front is rather prominent, the length of head at antennae about equal to length at vibrissae. Occiput bulged in middle inferiorly. No acrostichals. Two dorsocentrals before suture. Three postsuturals and three sternopleurals. Posterior lateral pair of scutellars nearly reaching base of anal segment. Long costal spine. First vein bristly whole length, third vein bristly to small crossvein. Apical crossvein strongly bent in at base. Claws of male only a little elongated, about as long as the last tarsal joint.

PUNAPHYTO TRIDENS, new species.

Length of body, 4 to 6 mm.; of wing, 3 to 4.5 mm. Four males, Oroya, Peru, over 12,000 feet, valley of the Rio Mantaro, May 7, 1914 (Townsend).

Black, brassy-cinereous pollinose. The black parts include palpi antennae, frontalia; three strong broad equal vittae on thorax, the middle one continued over scutellum; a lateral stripe extending from point a little in front of suture to sides of scutellum, broad stripe from humerus to wing-root, sternopleural and hypopleural regions; three vittae on abdomen, confluent along hind margins of all the segments; and the legs. The head pollen is but faintly brassy, that of thorax a little more so, that of abdomen rather cupreous than brassy. Wings clear except faintly smoky-yellow costobasal area. Tegulae nearly white, tawny-yellowish on borders.

Holotype.—Cat. No. 19432, U.S.N.M.

Family SALMACIIDAE.

PLAGIMASICERA, new genus.

Genotype.—Plagimasicera petiolata, new species.

Differs from *Plagiprospherysa* as follows: Eyes thinly but decidedly hairy. Female front about one and one-half times eye-width anteriorly, a little narrowed at vertex. Face but little widened from front. Palpi better developed, slender. Scutellum with a weak suberect nondecussate apical pair of bristles, and three strong laterals. Abdominal macrochaetae of female discal and marginal. Costal spine conspicuous. Apical cell long-petiolate, ending far before wing tip, the petiole about half as long as hind crossvein; latter distinctly nearer to cubitus. Differs from *Cyrtophleba* by second aristal joint being short, parafacials bare, macrochaetae of intermediate abdominal segments discal and marginal.

Frontals descending to base of third antennal joint. Second antennal joint rather elongate, the third about three times as long as second. Parafacials very narrow below, about twice as wide above. Facialia narrow above, twice as wide below. Facial plate about as wide as facialia plus parafacial of one side. Cheeks about one-third eye-height. Proboscis a little shorter than head-height, very fleshy. Length of head at vibrissae about three-fourths that at antennae. Epistoma distinctly produced. Palpi distinctly but only slightly thickened at tips. Female with two verticals, the outer one much shorter than the inner one, the two inner ones not decussate. Cilia of facialia strong, about six or seven in number, not closely placed, reaching as far up as origin of arista. Third antennal joint of female moderately narrow, equilateral, elongate. Two proclinate orbitals in female. A divaricate-proclinate pair of ocellar bristles. Three sternopleurals, the two front ones closely approximated. Three postsuturals. First abdominal segment with a median marginal pair of macrochaetae, second and third segments with median discal pair, second with median marginal pair, third with marginal row, anal with mixed discal and marginal bristles. Hind tibiae of female not ciliate. Third vein bristly about halfway to small crossvein. Hind and apical crossveins subparallel. Last section of fifth vein distinctly more than half as long as preceding section.

PLAGIMASICERA PETIOLATA, new species.

Length of body, 6 mm.; of wing, 4.25 mm. One female, Chosica, Peru, about 2,800 feet, indoors, June 21, 1913 (Townsend).

Facial plate and cheeks silvery-gray. Parafrontals pale old-gold pollinose, parafacials and ocellar area with tinge of same. Frontalia fulvo-testaceous. First two antennal joints and broad base of third clear light rufous, rest of third joint and all of arista black. Palpi fulvous. Mesoscutum and scutellum silvery, with very faint tinge of golden; two narrow median and two heavy interrupted outer vittae. Venter and tip of anal segment light rufous. Tergum of abdomen shining black or dark brown, with basal half of segments two to four silvery-white pollinose. Legs black. Wings nearly clear. Tegulae watery-white.

Holotype.—Cat. No. 19433, U.S.N.M. TD 4165.

PROTOGONIOPSIS, new genus.

Genotype.—*Protogoniopsis arida*, new species.

Differs from *Protogoniops* by the thickly hairy eyes of female, only one row of frontals outside the strong descending row, arista geniculate and thin on tip, ocellars weak, pair of median marginal macrochaetae on first abdominal segment. Ocellars divaricate-proclinate. Second aristal joint very long, over one-third as long as third joint. Proboscis fleshy, not corneous, not as long as head-height. Female front in middle one-half head-width. Two proclinate and two reclinate fronto-orbitals in female. Parafrontals, parafacials, and cheeks with short black bristles, those of parafacials in four quite regular rows. Facialia sparsely ciliate with strong bristles. Parafacials very wide, wider than facial plate. Frontal bristles descending low and very obliquely. Apical scutellar pair of bristles decussate, next pair extending one-third way over third abdominal segment. No discal macrochaetae on abdomen; first two segments each with median marginal pair. Hind tibiae pectinate, with long spine near middle.

Seems allied to *Goniophana* of Australia.

PROTOGONIOPSIS ARIDA, new species.

Length of body, 9 mm.; of wing, 7.5 mm. One female, Goatherd Camp, Chosica Canyon, above Chosica, Peru, about 6,000 feet, on bare ground, June 7, 1914 (Townsend).

Blackish in ground color, silvery to cinereous pollinose; abdomen submarmorate. Face and cheeks dull silvery-whitish; front with brassy tinge. Frontalia and first antennal joint brownish, second antennal joint and palpi pale rufous, third antennal joint and arista black. Thorax silvery, showing four subequal black vittae and a fifth one behind suture. Scutellum testaceous, silvery pollinose, blackish on base. Abdomen silvery-marmorate, with suggestion of brassy in some lights. Legs blackish, middle and hind tibiae largely rufous. Wings nearly clear. Tegulae nearly white.

Holotype.—Cat. No. 19434, U.S.N.M. TD 4274.

ECHINOMASICERA, new genus.

Genotype.—Echinomasicera hystrix, new species.

Differs from *Masicera* in male possessing two strong proclinate orbitals, facialia strongly ciliate, hind tibiae ciliate, and abdomen thickly set with subspinelike macrochaetae on disk of second and all of third and anal segments.

Differs from *Blepharipeza* by the male orbitals, arista strongly thickened on basal third, strong proclinate ocellar bristles, male front at vertex nearly equal to eye-width, palpi but little broadened on apical two-thirds, frontals descending low, cubitus well removed from wing-margin, male claws hardly as long as last tarsal joint, four sternopleural and four postsutural bristles.

ECHINOMASICERA HYSTRIX, new species.

Length of body, 12 mm.; of wing, 11 mm. One male, Matucana, Peru, about 8,000 feet, May 1, 1914, on foliage (Townsend).

Black; whole head lightly silvery-white pollinose, changing to dark according to light incidence. Palpi black, faintly obscure reddish-fulvous on tips. Antennae deep black. Frontalia dark brown. Mesoscutum very thinly pollinose, three narrow vittae in middle, broad broken one on each side. Scutellum obscure reddish-fulvous, black on base and sides, tinged with black on disk. Abdomen obscure dark rufous on outer third of second segment. Wings subhyaline, faintly smoky throughout, yellow-fuscous on base narrowly following the veins. Tegulae watery-fuscous, narrow margins blackish.

Holotype.—Cat. No. 19435, U.S.N.M.

This species greatly resembles in general appearance *Blepharipeza montagna* Townsend and *Fabriciopsis hystrix* Townsend, which are respectively from Uruhuasi and Casahuiri, in the south Peruvian montanya.

BELVOSIOMIMA, new genus.

Genotype.—Belvosiomima fosteri, new species.

Differs from *Triachora* as follows: Whole body very much broadened. Vertex much exceeding one-third of head-width, but less than one-half same. Facial depression of female deeper, that of male greatly deepened. Cheeks fully one-half eye-height in female, those of male about two-fifths same. Antennae longer, the third joint of male heavily bulged on upper edge at base. Arista longer, broadly flattened all way to tip. Epistoma of male narrowed, with slope of 45° from plane of clypeus. Palpi heavier. Head bristles stronger. Claws of both sexes are short. Front as well as all tarsi of female broad, and heavily thickened.

BELVOSIOMIMA FOSTERI, new species.

Length of body, 11 to 12 mm.; of wing, 8.5 to 9.75 mm. Two females and one male, Sapucay, Paraguay, February (W. T. Foster).

Rufous in general ground color. Head luteous, including frontalia, the whole of face silvery-white, the front and cheeks showing less so. Antennae and palpi rufous, the third antennal joint shaded with blackish on upper edge and tip especially in male. Mesoscutum blackish except hind margin, thinly yellowish-gray pollinose, with four vittae, and a fifth one behind suture. Scutellum more or less completely luteous or rufous. Abdomen thickly pale gold pollinose on whole of anal segment and very narrow bases of second and third segments, the pollen of third extending more thinly over all of segment except a broad hind border, varying with light incidence, and that of second similarly still more thinly extended. Legs dark brown, tarsi black. Wings slightly infuscate, tegulae very pale yellow.

Holotype.—Cat. No. 19607, U.S.N.M., female.

Family CROCUTIDAE.

CALPODOMYIA, new genus.

Genotype.—*Calpodomyia linearis*, new species.

Very small. Female only described. Eyes very large, taking up nearly the entire area of the head in profile, only the front showing as a rim outside their borders; bare, descending even lower than vibrissae. Parafacials and cheeks linear. Front and face of equal width, conspicuously less than eye-width, about four-fifths of same. A well-marked median facial carina present, formed like a ridge of a roof. Oral margin cut off, inverted broad V-shape, the median notch higher than vibrissal insertion, the carina running uniformly from notch to insertion of antennae. Antennae closely approximated, inserted above eye-middle; second joint short, third about three and one-half times as long as second. Arista thickened on less than basal half, microscopically short-pubescent. Frontalia broad, normally occupying fully one half width of front. Frontal and facial profiles both curved or bulged, the former more prominent. Weak pair of proclinate ocellars. Two proclinate and two reclinate fronto-orbitals. Two verticals, the outer one weak. Frontals descending to base of third antennal joint. Proboscis very short; palpi short, widened apically. Facialia with about three short bristles above vibrissae, peristomals about same number and size. Scutellum subtriangular, with three lateral macrochaetae, the hindmost longest and divaricate; no discal, no apical. Macrochaetae of abdomen only marginal. Femora rather broad; claws very short. Apical cell closed in margin, ending just before wingtip. Cubitus curved, without wrinkle. Hind crossvein in middle. Third vein bristly to small crossvein. First vein bare. No costal spine. Probably related to the Thryptoceratinae.

CALPODOMYIA LINEARIS, new species.

Length of body, 2.25 to 2.5 mm.; of wing, 1.75 to 2 mm. Two females, Mayaguez, Porto Rico, November 18, 1912, reared from larva of *Calpodes ethlius* Cramer (C. W. Hooker), through R. H. Van Zwalenwenberg. Porto Rico No. 5071.

Brown to blackish. Head silvery, frontalia and antennae brownish to blackish; parafrontals black, thinly silvery. Palpi obscurely rufotestaceous. Scutellum dark testaceous. Thorax thinly pollinose; four vittae very faintly showing anteriorly, the outer ones broader. Abdomen showing pollen on bases of segments two to four, narrowly on two, widely on four. Legs brownish. Wings clear. Tegulae tawny-whitish.

Holotype.—Cat. No. 19436, U.S.N.M.

Family MINTHOIDAE.

NEOMETACHAETA, new genus.

Genotype.—*Neometachaeta polita*, new species.

Differs from description of *Metachaeta* as follows: Male only described. Third antennal joint three and one-half times as long as second. Arista thickened on hardly over basal half, basal joints short. Ocellar bristles present. Parafacials about one-fifth as wide as facial plate. Face only slightly receding, profile of parafacials a little convex. Cheeks about one-third eye-height or somewhat less. Palpi subcylindrical, but slightly thickened at tip. Proboscis short. Male front at vertex about one and one-third times eye-width. Male with two reclinate inner fronto-orbitals; two verticals; five or six weak short proclinate outer fronto-orbitals, the posterior one approximated to the posterior inner orbital, the anterior one just in advance of the lowest frontal; five or six downwardly directed facio-orbitals in line with frontal row, not in exact line with outer fronto-orbitals. Two sternopleurals and three postsuturals. Scutellum with apical pair, and two lateral pairs of which the posterior is very strong. Abdomen elongate-conical. Abdominal macrochaetae weak; segments one and two with a lateral, two and three with a median marginal pair, three with a lateral marginal pair, four with marginal row. Claws of male a little shorter than last tarsal joint. Costal spine vestigial. First vein bristly on its proximal half, third bristly nearly to small crossvein. Petiole of apical cell about as long as hind crossvein; latter crooked and nearer to small crossvein than to cubitus, which causes last section of fifth vein to be over half as long as preceding section. Cubitus angular, with pronounced wrinkle; apical crossvein deeply bent in at base. Third vein ends halfway between second vein and wing tip.

NEOMETACHAETA POLITA, new species.

Length of body, 4.5 mm.; of wing, 3 mm. One male, Chosica Canyon, above Chosica, Peru, about 4,000 feet, April 4, 1913, on ground (Townsend).

Whole head silvery-white, including occiput. Frontalia velvet-brown. Palpi and second antennal joint rufous, rest of antennae blackish. Thorax and scutellum silvery-white, with two broad polished black vittae which extend on sides of scutellum. Abdomen polished black, with three narrow equal silvery-white fasciae of pollen on bases of second to fourth segments. Venter and femora thinly silvery, rest of legs blackish. Wings clear, deeply smoky-blackish on humeral, costal, subcostal and marginal cells. Tegulae pure white.

Holotype.—Cat. No. 19437, U.S.N.M. TD 4143.

PSEUDEUANTHA, new genus.

Genotype.—*Pseudeuantha linellii*, new species.

Differs from *Euantha* as follows: Arista bare, longer. No distinct facial carina. Eyes of female quite thickly hairy. Second antennal joint elongate, third joint about twice as long. Vibrissae on oral margin. Front tarsi of female like the others, not thickened or compressed. No costal spine, apical cell more attenuate distally, cubitus a little nearer hind margin of wing.

This genus was labeled many years ago by Mr. Martin L. Linell, aid, department of insects, United States National Museum, as *Pseudeuantha*, a manuscript name. Linell's name is adopted and the species is named for him in recognition of his fine sense of discrimination and just concepts of muscoid genera, as shown by the unpublished determinations of United States National Museum material made by him in this group.

PSEUDEUANTHA LINELLII, new species.

Length of body, 12 mm.; of wing, 9.5 mm. One female, Tehuantepec (Sumichrast).

Black, with silvery pollen. Entire head pollinose except the blackish frontalia and antennae; palpi rufous, with fulvous tips. Thorax, scutellum, and pleuræ pollinose; two narrow black vittae in middle of mesoscutum before suture, and two heavier ones on each side continued indistinctly behind suture. Second and third abdominal segments broadly pollinose on base, except in middle, where the pollen band fades or narrows, the pollen similarly continuing on venter. Front femora silvery on the outside. Wings deeply yellow on oblique antero-basal area, taking up a little less space than the large deeply smoky area extending from fifth vein obliquely to costa and wing tip; the veins in the yellow area are yellowish, but change to brown in the smoky area; anal area behind fifth vein subhyaline. Tegulae white.

Holotype.—Cat. No. 19438, U.S.N.M.

MINTHOPSIS, new genus.

Genotype.—*Minthopsis vittata*, new species.

Differs from *Mintho* as follows:

Female.—Parafacials with microscopic hairs. Cheeks two-fifths eye-height or rather more. Vibrissae decussate on extreme tips, inserted well above oral margin. Second antennal joint elongate, the third joint only three or at most four times as long as second. Facialia ciliate. Arista nearly bare, thickened hardly over one-third way, second joint hardly twice as long as wide. Ocellar bristles present. Frontals descending lower. Front much wider than one eye; frontalia very broad, nearly or quite equilateral. Eyes distinctly and rather thickly short-hairy. Head scarcely wider than thorax. Two sternopleural bristles only. No discal macrochaetae on intermediate abdominal segments; no median on segment one, a lateral on segments one to three, median marginal pair on two and three, discal and marginal on anal segment. Abdomen short. Front tarsi moderately swollen subcylindric, not so flattened laterally; all metatarsi very long; all claws short, the front ones modified. Apical cell closed distinctly before wingtip. Cubitus rounded, without stump or wrinkle. Hind crossvein nearer to cubitus than to small crossvein.

Male.—Differing from the female as follows: Second antennal joint very short; third very long, reaching vibrissae, about six or seven times as long as second. Arista subgeniculate, thickened fully halfway or more; second joint very long, about four times as long as wide. Facialia not so strongly ciliate. Eyes almost bare, with only very sparse hairs, mostly above and almost imperceptible. Parafrontals narrower, but frontalia about same width. Parafacials narrower, appearing more elongate. Vibrissae nearer to oral margin, weaker, barely or not decussate. Frontals not descending so low, weaker. Three sternopleural bristles, the third being below the front one of the other two. Cheeks hardly one-third eye-height. Middle metatarsi longer than others. Claws all short, the front ones normal; tarsi all slender. Abdomen and whole body much narrowed, including head. A median marginal pair of macrochaetae and one lateral on segments one to four. Apical cell closed in wingtip. Hind crossvein in middle between cubitus and small crossvein.

This is probably one of the most notable cases of sexual differentiation in the superfamily, so far as characters that are ordinarily of generic value are involved.

MINTHOPSIS VITTATA, new species.

Length of body, 5 to 6.5 mm.; of wing, 4 to 6 mm. Four females and two males, Huariaca, Peru, high montanya of the Rio Huallaga canyon, about 10,750 feet, December 20 and 21, 1913, on foliage (Townsend).

Female.—Blackish, silvery pollinose, largely golden above. Cheeks and occiput silvery-white, former often tinged with brassy in front, facial plate brassy-silvery, parafacials and parafrontals deep golden, frontalia and antennae velvety-black or dark brown, antennae obscurely fulvous on base of third joint, palpi fulvous. Mesoscutum deeply pollinose with pale gold to golden-whitish, leaving two very broad velvet-black vittae which do not reach scutellum. Pleurae silvery-white, with slight marmoration. Scutellum and abdomen dull ashy-gold, with marmorations in two mediobasal spots on segments two to four and a posterolateral spot on segments two and three. Venter cinereous. Femora fulvous, faintly silvery, blackish on tips; tibiae pale rufous, tarsi blackish. Wings clear; tegulae watery-whitish, hind scale with tawny or obscure tinge.

Male.—Facial plate deep golden, extending on cheeks. Antennae wholly black. Abdomen more thickly pale gold pollinose, with broad blackish hind borders to all segments, these being connected by a narrow median vitta of blackish. Venter pale golden. Tibiae all black except rufous tinge on middle of intermediate and hind pairs.

Holotype.—Cat. No. 19439, U.S.N.M., female. TD 4206. Allotype, male. Paratypes, male, TD 4213; females, TD 4205, 4219.

NEOMINTHOPSIS, new genus.

Genotype.—*Neominthopsis discalis,* new species.

Differs from *Minthopsis* as follows: Facialia ciliate only one-third way up. Parafacials bare. Cheeks hardly over one-fourth eye-height in female. Eyes distinctly but very thinly hairy. Long erect discal bristles on intermediate abdominal segments. Anal segment with marginal, submarginal, and discal transverse rows, and an anterior discal pair of bristles. Median marginal pair on segment one. Three sternopleurals and three postsuturals. Female tarsi normal, front ones with long claws, metatarsi not unusually long. Legs not elongate or slender. Apical cell open just before wingtip.

NEOMINTHOPSIS DISCALIS, new species.

Length of body, 6.75 mm.; of wing, 5.5 mm. One female, Pachacayo, Peru, about 12,000 feet, on flowers of *Eupatorium,* sp., March 27, 1913 (Townsend).

Strongly resembles *Minthopsis vittata,* differing in coloration from description of that species only as follows: Silvery pollinose, without distinct tinge of golden. Antennae wholly black. Scutellum silvery, the sides blackish. Abdomen silvery, with broad irregular black median vitta which spreads more or less along hind margins of segments one to three, invading base of anal segment in middle. Legs black, femora silvery on outside. Wings faintly tinged with smoky-yellow. Tegulae pale yellow, hind scale white on disk. The pollen of thorax and abdomen shows a suggestion of brassy in some lights. No marmoration on abdomen.

Holotype.—Cat. No. 19440, U.S.N.M. TD 4138.

EPIPHANOCERA, new genus.

Genotype.—*Epiphanocera costalis*, new species.

Differs from *Neominthopsis* as follows: Front at vertex slightly narrower, about one-third head-width in both sexes. Frontalia not quite so broad, a little wider than one parafrontal in female, slightly wider in male. Facialia bare. Antennae considerably heavier, nearly alike in both sexes, slightly longer in female than in male; third joint gently rounded apically, with slight angle on upper apical corner. No discal abdominal macrochaetae in either sex, even on anal segment. Cheeks nearly one-third eye-height in both sexes. Palpi widened and flattened, upper surface smooth and nearly bare. Wings conspicuously broader, apical cell ending in exact wingtip. Legs, especially tarsi, more slender. Claws short in both sexes, and both with two proclinate fronto-orbitals. Female without piercer.

EPIPHANOCERA COSTALIS, new species.

Length of body, 6 mm.; of wing, male 5 mm., female 6 mm. One female and three males, Huariaca, canyon of the Rio Huallaga, Peru, about 10,750 feet, December 20 and 21, 1913, on foliage (Townsend).

Black, rather shining. Head silvery pollinose, the parafrontals with a faint golden tinge which is a little more marked in male. Frontalia and antennae soft black. Palpi pale fulvous, with silvery sheen. Thorax silvery; with two heavy broad black vittae on mesoscutum, each showing a short pollinose line just in front of suture; scutellum blackish. Abdomen polished black, the bases of last three segments rather broadly silvery-white with interruption on median line, the pollen with golden shade in male. Legs blackish, tibiae brownish. Wings clear, except fuscous costal area extending from costal spine to end of second vein. Tegulae pearly translucent whitish.

Holotype.—Cat. No. 19608, U.S.N.M., female. TD 4218. Allotype, male. Paratypes include TD 4210, male.

RHOMBOTHYRIOPS, new genus.

Genotype.—*Rhombothyriops elegans*, new species.

Differs from Brauer and Bergenstamm's description of *Rhombothyria* as follows: Arista practically bare, with only the most microscopic pubescence. Antennae of female reaching two-thirds way to oral margin, those of male about five-sixths way. Third antennal joint of female nearly four times as long as second, that of male about five times as long. Costal spine very short, but visible. Abdominal macrochaetae only marginal. Abdomen of male much narrower than that of female.

Closely similar to *Minthopsis vittata* in both structure and color, and evidently related to that genus, but generally more slender in form and legs much more elongate, besides the following characters: Second aristal joint of female barely twice as long as wide, that of male fully three times as long as wide. Front of male about width of one eye, that of female about one and one-fifth times eye-width. Male frontalia wider than those of female. Male parafrontals narrower than those of female; male parafacial plane practically parallel with the longitudino-vertical plane of head. Eyes very thinly short-hairy in both sexes, slightly more so in male, bare below in female. Vibrissae inserted well above oral margin in both sexes; the facial plate very elongate and nearly equilateral. In front view the male facialia-crests are quite in line with inner border of eyes. Facialia ciliate to well above middle in both sexes, more strongly so in male. Face and front nearly equal in width, former slightly wider, latter slightly narrowed at vertex. Proclinate ocellar bristles present. Eyes dscending as low as vibrissae in male, well short of same in female. Cheeks of female about one-third eye-height, those of male about one-fourth same. Frontal bristles descending to base of third antennal joint. Three sternopleural and three postsutural bristles. No decussate scutellar bristles, the long pair in middle divaricate. Abdominal segments one to three in both sexes with a median marginal pair of macrochaetae, and one or two lateral marginal; bristles of anal segment marginal only. Claws of both sexes short, practically alike. Legs long, metatarsi very long; front tarsi of female not noticeably swollen or modified. Apical cell open close to wingtip. Only two or three bristles at base of third vein. Hind crossvein decidedly nearer to cubitus in both sexes.

RHOMBOTHYRIOPS ELEGANS, new species.

Length of body, 5 to 6.5 mm.; of wing, same measurements. Two females and ten males, Huariaca, Peru, high montanya of the Rio Huallaga Canyon, about 10,750 feet, on foliage, December 20, 1913 (Townsend).

Pale golden pollinose, with wholly velvet-black antennae and arista, broad velvet-black frontalia, two velvet-black mesoscutal vittae of same width as frontalia, narrow blackish border to scutellum, and four broad velvet-black fasciae on abdomen occupying the hind half or so of the four segments. Cheeks and occiput paler, more silvery. Palpi fulvous, faintly smoky on tips. Male parafrontals invaded by the black from frontalia. Male scutellum prevailing black; mesoscutal vittae appearing confluent behind suture in male in certain lights. Postscutellum wholly golden. The abdominal fasciae narrow obliquely off laterally on front corners, and the mesoscutal vittae narrow off on inner hind corners. Abdominal fasciae with faint indication of bloom, which slightly dulls their luster. Pleurae and venter paler, brassy-silvery. Femora fulvous except tips, tibiae faintly reddish on middle, rest of legs velvet-black. Wings faintly smoky-tinged throughout. Tegulae pale yellow, pearly.

Holotype.—Cat. No. 19441 U.S.N.M., female. TD 4207. Allotype, male. Paratype, male, TD 4208.

LACHNOMMOPSIS, new genus.

Genotype.—*Lachnommopsis armata*, new species.

Differs from description of *Lachnomma* as follows: Male only. Oral profile nearly or quite as long as frontal, the epistoma being much produced and occiput swollen below. Vertex one-third of head-width or slightly more, face below nearly one-half head-width. Very closely-set row of downwardly-inclined bristles on parafacials, beginning just inside line of frontals near end of same and extending to point on level with lower end of eye, closely approximated to facialia. Parafacials about one-fifth as wide as facial plate. Cheeks hardly one-third eye-height. Vibrissae inserted well above extreme oral margin, though latter varies with wrinkling. Eyes descending to bend of facialia, at which point the cilia of facialia stop. Antennae inserted far above eye-middle; third joint about four times as long as the slightly elongate second, perfectly straight and equilateral, not very wide. Arista thickened three-fourths or more to tip. Proboscis not as long as head-height; palpi subfiliform, not thickened at tip. Claws only a little elongate, the front ones more so than others. Abdominal macrochaetae only marginal, even on anal segment. Third vein spined halfway or so to small crossvein. Apical cell very narrowly open, almost closed in margin, ending conspicuously but yet only a little before wingtip.

LACHNOMMOPSIS ARMATA, new species.

Length of body, 5.5 to 7 mm.; of wing, 4 to 5.5 mm. Four males, Chosica, Peru, 2,800 feet, indoors; one January 20, two May 25, and one July 17, all 1913 (Townsend).

Blackish, thickly cinereous pollinose, upper parts including parafrontals with faint brassy tinge to the pollen. Antennae and arista black, the second antennal joint more or less rufous. Palpi fulvous. Frontalia brownish, pollinose. Thorax with four moderately narrow nearly equal blackish vittae, the outer ones of the semicolon type, a linear median one behind suture. Abdominal tergum marmorate. Legs black. Wings clear, bases pale yellowish. Tegulae tawny-whitish.

Holotype.—Cat. No. 19442, U.S.N.M. TD 4163.

HYPOCHAETOPSIS, new genus.

Genotype.—*Hypochaetopsis chaetosa*, new species.

Belongs with *Hypochaeta* and *Parahypochaeta*, differing from latter as follows: First vein bare. Apical cell widely open, ending almost in wingtip, only slightly before. Costal spine rather short. Cheeks of female hardly one-fourth eye-height. Third antennal joint of female only three times as long as second. Face very receding, cheeks extremely short. Frontal bristles very long and heavy, very strongly decussate. Ocellar bristles widely divaricate, distinctly reclinate. Outer verticals absent in female. Parafacials very narrow. Occiput swollen below. The inner of the two lateral scutellar bristles is very much longer than both the outer one and the strongly decussate apical pair. Abdominal macrochaetae very long, strong, suberect, discal and marginal on segments two to four. All the tarsi elongate, the front pair in female still more elongate than the others; tarsal joints much constricted basally, giving tarsi a strongly notched or very coarsely pectinate profile, especially marked in the modified front tarsi of female. Claws short in female.

HYPOCHAETOPSIS CHAETOSA, new species.

Length of body, 6 mm.; of wing, 5 mm. One female, Huariaca, Peru, high montanya of the Rio Huallaga canyon, about 10,750 feet, on foliage, December 21, 1913 (Townsend).

Entire head, thorax, and abdomen cinereous pollinose with a faint brassy tinge, even covering the frontalia. Antennae blackish, palpi fulvous to pale rufous. Four dusky vittae on mesoscutum, the inner pair sublinear and shorter than the outer, which are interrupted. Legs blackish, femora faintly pollinose, tibiae rufous except at base. Abdomen faintly marmorate. Wings very dilute yellowish-fuscous, the smoky tinge not quite uniform. Tegulae faintly yellowish-smoky, front scale limpid whitish.

Holotype.—Cat. No. 19443, U.S.N.M. TD 4220.

CHAETOPHLEPSIS, new genus.

Genotype.—*Chaetophlepsis tarsalis*, new species.

Differs from *Hypochaeta* as follows: Geno-orbital bristle low, crowded into margin of the hairy occipital area of cheeks, a second similar bristle just below it and approximated to it. Cheeks only about one-fifth eye-height. Face very receding. Third antennal joint only four times as long as second, small, narrow, equilateral. Arista thickened on basal third. No outer vertical bristle in female. Female front equilateral, about as wide as one eye. Eyes rather indistinctly short-hairy. Parafacials very narrow below, hardly wider than facialia. Facial plate deeply sunken. Oral margin cut off, vibrissae on same. Frontalia not delimited by color from parafrontals, all equally pollinose. Cilia of facialia very sparse. Proboscis short and fleshy, palpi subcylindrical. Two sternopleurals and three postsuturals. No median macrochaetae on first abdominal segment in female. Hind tarsi of female shorter than others, the hind metatarsi shortened and thickened. Front tarsi of female not widened. Apical cell almost closed in margin a little before wingtip. Small crossvein nearly opposite end of auxiliary vein, hind crossvein well approximated to small crossvein, the last section of fifth vein about as long as preceding section. First vein bristly whole length. Costal spine small. No piercer in female.

CHAETOPHLEPSIS TARSALIS, new species.

Length of body, 5.5 mm.; of wing, 4 mm. One female, San Rafael, Casma, Peru, April 1, 1912, on cotton foliage during outbreak of *Alabama argillacea* (Townsend).

Blackish in ground color, silvery-cinereous pollinose. Face and cheeks silvery-whitish. Whole front including frontalia pollinose, with pale golden tinge. Pollen of mesoscutum and scutellum faintly golden. Thoracic vittae practically obsolete, only a faint trace of linear median pair in front. Abdomen also with faint brassy tinge to the pollen. Femora with faint bloom, tibiae reddish-fulvous, tarsi black. Wings nearly clear, faintly yellow at stigma. Tegulae watery-white.

Holotype.—Cat. No. 19444, U.S.N.M. TD 4087.

MICRONYCHIOPS, new genus.

Genotype.—*Micronychiops aurescens*, new species.

Runs to *Micronychia* in Brauer and Bergenstamm's tables, but may be distinguished by the following characters: Ocellar bristles distinct but not large, proclinate. Proboscis shorter than head-height. Eyes hairy. Vibrissae above oral margin, latter produced. Female with inner and outer vertical bristles both strong, the inner ones decussate. Two proclinate fronto-orbitals in female, and two reclinate inner ones. Frontals strong like orbitals and verticals, except anterior ones. Front of female about equal to eye-width. Palpi long, slightly clavate. Third antennal joint about two and one-half times second, latter hardly elongate. Arista thickened on basal third, basal joints short. Two sternopleurals and three postsuturals. Scutellum with two strong lateral macrochaetae, the posterior one longer; long strong apical decussate pair, same length as anterior lateral. Abdominal macrochaetae only marginal, long. Segments three and four with marginal row, two with median marginal pair and one lateral marginal, one with one lateral marginal. Front tarsi of female widened, hind tibiae not ciliate. Apical cell open in wingtip. Cubitus rounded, as near to hind margin of wing as is the posterior end of hind crossvein, latter nearer to cubitus. No costal spine. First vein bare, third bristly only at base.

MICRONYCHIOPS AURESCENS; new species.

Length of body, 7 mm.; of wing, 6 mm. One female, Huancayo, Peru, about 10,500 feet, on foliage of *Baccharis*, sp., March 25, 1913 (Townsend).

Dark in ground color, pale golden pollinose. Head thickly pollinose, with pale gold tinge which is most marked on facial plate and parafrontals. Mesoscutum, scutellum, and abdomen quite as thickly pale gold pollinose; former with two linear median vittae stopping a little behind suture, and two interrupted outer vittae of the semicolon type extending farther back. Abdomen submarmorate in a faint median vitta on first two segments, hind lateral spots to all segments, and lighter median pair of spots on front margin of third and fourth segments. Femora and tibiae pale rufous or subfulvous, tarsi black. Wings practically clear. Tegulae very pale pearly-yellowish.

Holotype.—Cat. No. 19445, U.S.N.M. TD 4129.

OESTROGASTROPSIS, new genus.

Genotype.—*Oestrogastropsis mexicana*, new species.

Differs from *Oestrogaster* as follows:

Female.—Front nearly one-fourth head-width, sides slightly bulged on middle. Small pair of ocellars. Face at vibrissae (space between eyes) hardly one-third head-width. Antennae inserted on eye-middle. Parafrontals as wide as frontalia, or slightly wider. Parafacials about as wide as facialia. Outer verticals well developed, fully one-half as long as inner. The two proclinate fronto-orbitals are well out of line of frontals. Three reclinate fronto-orbitals, the hind one weak. Three lateral scutellar bristles, the hindmost reaching nearly or quite to base of third abdominal segment; a weak apical pair of divaricate bristles present, and a weak discal pair. Abdominal macrochaetae stronger, erect; second segment with median discal pair; third segment with four median discal in transverse line. Genital opening not pushed so far forward, being on apical two-thirds of abdomen; intermediate segments comparatively little shortened ventrally; anal segment keellike on median posteroventral line, rounded on posterior aspect. Two strong spines on middle of front aspect of middle femora. Hind tarsi slightly longer than hind tibiae. Apical cell almost closed, ending slightly before wingtip. Hind crossvein scarcely approximated to cubitus. Third vein with two or three bristles at base.

OESTROGASTROPSIS MEXICANA, new species.

Length of body, 6.5 mm.; of wing, 6 mm. One female, San Rafael, near Jicaltepec, Veracruz, March 29, 1896 (Townsend).

Whole body silvery-cinereous, the face, orbits, and anterior half of parafrontals more silvery-whitish. Frontalia and antennae dark brown. Palpi rufous; legs blackish. Four blackish thoracic vittae, all interrupted. Base of scutellum rich shining brown. Basal abdominal segment nearly same brown, the hind borders of second and third segments with a dark shade in some lights. Keel of anal segment pale rufous, venter and sides showing some rufous. Wings clear. Tegulae tawny-whitish.

Holotype.—Cat. No. 19565, U.S.N.M.

OESTROGASTRODES, new genus.

Genotype.—*Oestrogastrodes similis*, new species.

Differs from *Oestrogastropsis* as follows:

Female.—Only two reclinate fronto-orbitals, the hind one weak. The middle one of the three lateral scutellars is weaker, the hind one reaches barely to middle of second abdominal segment. No apical pair of scutellars. Third abdominal segment with only two median discals. Anal segment rounded on posterior aspect, the ventral keeled portion short and terminating in an angle behind as seen in profile. All tarsi longer than tibiae, the hind ones conspicuously so. Apical cell open, ending distinctly before wingtip. Hind crossvein oblique, not perpendicular to fourth vein, conspicuously approximated to cubitus. Antennae inserted above eye-middle. Arista pubescent. Proclinate fronto-orbitals set farther forward.

OESTROGASTRODES SIMILIS, new species.

Length of body, 6.5 to 7.5 mm.; of wing, 6 to nearly 7 mm. Two females, San Rafael, near Jicaltepec, Veracruz, Mexico, March 29, 1896 (Townsend), and Arajan, Panama, April 28, 1911 (A. Busck).

Differs from *Oestrogastropsis mexicana* Townsend in coloration as follows: Pollen silvery-white, the upper parts with a more or less pronounced bright golden-yellow shade. The four thoracic vittae heavier, the middle pair confluent behind suture in a rectangular rich brown marking. Base of scutellum, all of first abdominal segment, and broad hind borders of second and third segments rich shining brown. Femora and front tibiae more or less yellow or yellowish. Face and pleurae silvery-white. Antennae and palpi pale yellow, the third antennal joint dusky apically. Wings faintly smoky, tegulae white.

Holotype.—Cat. No. 19609, U.S.N.M., Panama. The Veracruz specimen may prove to be a distinct form. It is the smaller, and shows in general duller coloring.

ARGYREOMYIA, new genus.

Genotype.—Argyreomyia busckii, new species.

Differs from *Hemiargyra* as follows:

Male.—Front not as prominent, equilateral, about four-fifths as wide as one eye; parafrontals projected inward over frontalia on anterior half where they nearly meet, after the manner of *Metopiops*, posteriorly merged with frontalia; only one proclinate fronto-orbital; facialia bare; parafacials narrower, conspicuously narrowed below; eyes descending as low as vibrissae, cheeks very narrow; only three pairs of frontals, if we except a decussate reclinate pair behind them which appear as a third pair of reclinate fronto-orbitals but are in line with frontals. Face only a little widened from front, about one and one-half times vertex at widest. Main thoracic chaetotaxy same, but only two preacrosticlials; no discals on second abdominal segment. Abdomen narrower, longer, ovo-conical. Hind tibiae sparsely pectinate, with longer bristle. Abdominal macrochaetae erect and long, anal segment with marginal and discal rows. Abdomen not thickly hairy. Third vein bristled to small crossvein; hind crossvein not so conspicuously approximated to cubitus.

ARGYREOMYIA BUSCKII, new species.

Length of body, 8 mm.; of wing, about 6.75 mm. One male, Porto Bello, Panama, March 14, 1911 (Busck).

Whole face, front, and mesoscutum burnished silvery-white; pleurae and outside of front femora also silvery-white, but lacking the burnished effect; scutellum and abdomen silvery-white, not burnished, the first segment and rather broad hind margins of last three blackish, the pollen of bases of segments with a brassy tinge successively broadening to anal segment, which is more than half so covered. Legs black. Palpi rufous. Antennae obscure, third joint showing slight rufous shade, the whole covered with silver bloom. Wings clear, the costa tinged with smoky-golden. Tegulae white. The posterior half of frontalia is silvered like the parafrontals with which it is merged; the anterior half shows only as a brown line.

Holotype.—Cat. No. 19610, U.S.N.M.

Family LARVAEVORIDAE.

EXORISTOPSIS, new genus.

Genotype.—Exoristopsis setifera, new species.

Differs from *Exoristoides* as follows: Third antennal joint absolutely straight on front border. Frontal bristles descending about to arista. Cheeks hardly one-fourth eye-height. Arista thickened on basal two-fifths, second joint not longer than wide. Three sternopleurals. Front tarsi of female normal. First vein bristly whole length, third vein bristly to or even beyond small crossvein. Apical cell ending about as far before wing tip as length of second antennal joint, open. Fourth vein rounded, only gently bent in after cubitus. Hind crossvein much nearer cubitus. A hairlike pair of ocellar bristles.

EXORISTOPSIS SETIFERA, new species.

Length of body, 7 mm.; of wing, 5 mm. One female, Chosica, Peru, about 2,800 feet, May 9, 1913, on flowers of *Mikania*, sp. (Townsend).

Black, ashy pollinose, upper parts with pale golden tinge. Face rather silvery pollinose, parafrontals light golden pollinose. Frontalia dark brown. Antennae blackish, the articulation of second and third joints rufous. Palpi rufous, blackish on base. Thorax showing four vittae, the outer ones slightly heavier than the inner. Tip of scutellum paler. Whole upper surface very pale golden pollinose, the golden tinge increasing toward tip of abdomen; leaving only the thoracic vittae, first abdominal segment and lateral incisures of abdomen blackish, the tip of abdomen light rufous under the pollen. Legs black. Wings clear. Tegulae nearly white, the hind scale rather watery.

Holotype.—Cat. No. 19446, U.S.N.M. TD 4150.

ZYGOFRONTINA, new genus.

Genotype.—*Zygofrontina capitis*, new species.

Differs from description of *Azygobothria* only as follows: Female only. Front at vertex considerably wider than eye, at antennae nearly one and one-half times eye-width. Face below four-sevenths of head-width. Facialia strongly ciliate nearly or quite halfway up, but short of the lowest frontals; latter descending below aristal insertion. Eyes very large, cheeks not over one-fifth eye-height. Third antennal joint about four and one-half to five times as long as second. Arista thickened on basal two-thirds, hardly as long as third antennal joint, basal joints each as long as wide. The weak apical pair of scutellar bristles is suberect, curved upward. Median marginal macrochaetae of second abdominal segment vestigial, barely differentiated from the short bristly hairs. Claws not as long as last tarsal joint, front tarsi not widened. Hind tibiae weakly ciliate. Fourth vein angular at bend. Eyes thinly set with very short and almost imperceptible hairs.

ZYGOFRONTINA CAPITIS, new species.

Length of body, 7 mm.; of wing, 5 mm. One female, San Rafael, Casma, Peru, on flowers of *Asclepias curassavica*, April 3, 1912 (Townsend).

Face and cheeks silvery, parafrontals deep brassy, frontalia and first two antennal joints brownish; third antennal joint rufous-orange on basal half, insensibly merging into the blackish of distal half. Occiput cinereous. Thorax, scutellum, and abdomen thickly brassy-cinereous pollinose; leaving five blackish vittae, the three inner ones narrow, the median obsolete in front of suture, the outer ones heavier. Scutellum showing faintly testaceous apically through the pollen. Abdomen with a submarmorate effect; first segment blackish; median vitta, hind borders of second and third segments, and pair of spots on same showing blackish according to lights. Legs black. Wings clear. Tegulae watery-white.

Holotype.—Cat. No. 19447, U.S.N.M. TD 4091.

PUNAMYIA, new genus.

Genotype.—*Punamyia transitionalis*, new species.

Differs from *Erigonopsis* as follows:

Female.—Only two proclinate orbitals. Basal aristal joints both short, no longer than broad. Epistoma normal, not of the dolichocephalic wedgelike type. Cheeks with bunch of four or five genoorbitals in middle, on edge of occipital area next groove. Parafacials with oblique irregular row of weak bristles extending from frontals to lower corner of eyes, the lowest stronger. Cheek grooves very broad anteriorly. Palpi longer than antennae. Proboscis hardly as long as head-height. Joints three to five of front tarsi slightly widened, the fifth more distinctly so. Costal spine strong, double. Apical crossvein bent in apically as in *Copecrypta*. Hind crossvein removed from apical crossvein by a distance equal to three or four times the length of small crossvein.

PUNAMYIA TRANSITIONALIS, new species.

Length of body, 7 mm.; of wing, 6 mm. One female, Oroya, Peru, over 12,000 feet, March 7, 1913 (Townsend).

Blackish, brassy-cinerous pollinose, subshining. Head obscurely colored; the face and cheeks silvery in some lights, brassy-blackish in others; parafrontals more distinctly brassy. Second antennal joint rufous, palpi rufous with black tips. One heavy median vitta on thorax, an interrupted one on each side. Scutellum broadly testaceous on border. Abdomen wholly dark ashy-brassy, shining with satinlike luster. Legs blackish, tibiae largely rufous. Wings lightly and evenly smoky. Tegulae nearly white.

Holotype.—Cat. No. 19448, U.S.N.M.

PAREPALPODES, new genus.

Genotype.—*Parepalpodes rimacensis*, new species.

Differs from description of characters of *Huascaraya* only as follows:

Female.—Abdomen more oval than rounded, not wider than thorax. Second and third front tarsal joints not quite so widened. Parafacials more hairy, cheeks more bristly. Parafacials proportionately wider. Possesses a very distinct facies from *Huascaraya*, yet, so far as detailing the actual characters goes, the same description would apply to both genera if not minutely drawn as to degrees of development of the various characters. The genotype almost exactly simulates *Epalpodes rimacensis* Townsend. Differs from *Epalpodes* in lacking ocellar bristles.

PAREPALPODES RIMACENSIS, new species.

Length of body, 8.75 mm.; of wing, 7.75 mm. One female, Matucana, Peru, about 8,000 feet, August 16, 1913 (Townsend).

Differs from descriptions of *Epalpodes equatorialis* and *rimacensis* as follows: Fifth thoracic vitta indistinct, obsolete in front of suture. Legs rufous, tarsi black. Abdomen rufous; the pale golden pollinose vitta expanding over posterior half of anal segment, the anterior half of anal segment black instead of posterior part of third segment; the second and third segments with broad median blotch of black forming a wide heavy black vitta, on which the broad but narrower pollinose vitta is laid. Lateral edges of abdominal tergites blackish along median line of venter. Tegulae watery-yellowish, tinged with fuscous.

Holotype.—Cat. No. 19449, U.S.N.M. TD 4178.

EUEPALPODES, new genus.

Genotype.—*Euepalpodes arcuatus*, new species.

Differs from *Euepalpus* Townsend in the following characters: The second and third antennal joints are equal; proboscis but little longer than head-height, stout but not fleshy; cheeks fully two-thirds eye-height; front tarsi of female a little dilated. Parafacials at narrowest hardly as wide as length of second antennal joint. Abdominal chaetotaxy somewhat different, the third segment with submarginal median short pair in addition to marginal row. Abdomen quite broad-oval, anal segment showing rather strongly arcuate anterior border. No vestige of palpi, not even bristlets. Strong ocellar bristles. Basal aristal joints short. Eyes bare, and parafacials pilose. The form of last two abdominal segments approaches that of *Signosoma* and allies. Comes near *Parepalpus*, but has two pairs of median marginal macrochaetae on second segment.

EUEPALPODES ARCUATUS, new species.

Length of body, 11 mm.; of wing, 9.5 mm. One female, Uruhuasi Bridge, San Gaban Canyon, Peru, about 6,500 feet, February 3, 1910, on flowers of *Baccharis*, sp. (Townsend).

Differs from description of *Euepalpus flavicauda* Townsend as follows: Cheeks and parafacials with brassy-gray hairs. Frontalia fulvous to rufous. First two antennal joints rufous. Scutellum

rufous, thinly silvery. Abdomen shining brown, without pollen on first three segments; anal segment wholly cupreous-cinereous pollinose, showing thickly so in oblique view. Legs black, tibiae slightly reddish. Wings subhyaline, tawny at base. Both scales of tegulae reddish-smoky.

Holotype.—Cat. No. 19453, U.S.N.M. TD 3949.

AGICUPHOCERA, new genus.

Genotype.—*Agicuphocera nigra,* new species.

Differs from *Cuphocera* as follows: Third antennal joint one and one-third to one and one-half times as long as second in both sexes. Abdomen broad, elongate, nearly as long as wings. Parafacials broader. No vestige of palpi. Both sexes may at once be distinguished from *Cuphocera* by the fact that the second antennal joint is never as long as third; in *Cuphocera* the second is longer than third in female, and at most equal to third in male. The genus comes near *Trichophora* in external characters, but may be known by the broad-elongate abdomen. It is much like *Micropalpus* in build, but the eyes are bare and the fourth vein is continued in a wrinkle.

AGICUPHOCERA NIGRA, new species.

Length of body, 12.5 to 14.5 mm.; of wing, 10.75 to 12.25 mm. Three males and three females, Chosica, Peru, about 2,800 feet, on flowers of *Baccharis,* sp., December 4 and 9, 1913 (Townsend).

Black. Head silvery-white pollinose; parafrontals thinly so, the dark ground color showing through, giving a faint brassy effect. Epistoma pearly-straw color, clypeus same with silvery-white bloom. Frontalia shading from luteous anteriorly to testaceous behind. First two antennal joints deep rufous, third joint and arista wholly black. Occiput cinereous, beard yellowish. Thorax thinly dusted with brassy-cinereous, leaving five ill-defined vittae. Scutellum testaceous, blackish on base. Abdomen wholly shining, varying from narrowly obscure rufous-brown on sides to deep black. Legs black, front femora pollinose on outside. Wings very faintly tinged with smoky throughout. Tegulae deep fuscous.

Holotype.—Cat. No. 19451, U.S.N.M., female. TD 4192. Allotype, male. Paratypes include TD 4191, female; and TD 4193, male.

NEOARCHYTAS, new genus.

Genotype.—*Neoarchytas inambarica,* new species.

Differs from *Archytas* as follows: No ocellar bristles. Second antennal joint not longer than third, about as long as third in female but shorter than third in male. First and second aristal joints both well elongate. Third antennal joint in female of nearly equal width, rounded apically, straight on front and hind borders; that of male wider and conspicuously convex on front border. Palpi only slightly widened apically, not so strongly bent at tips. Proboscis about one and one-third times head-height. Parafacials and cheeks without pile, with black bristly hairs. Eyes bare. Body narrowed. Female abdomen slightly swollen, male abdomen same width as thorax. Front tarsi of female not widened or dilated. Third vein bristly halfway or more to small crossvein.

NEOARCHYTAS INAMBARICA, new species.

Length of body, 7 to 10 mm.; of wing, 6 to 8.5 mm. Seven females and eight males, junction of the Yahuarmayo and Inambari rivers, about 1,700 feet, February 11, 1910, on foliage in openings and along edge of tropical rain-forest (Townsend).

Face, cheeks, and borders of parafrontals pale golden-silvery pollinose, the cheeks and frontal parts more distinctly golden, extending on frontalia; the orbits of parafrontals in male more blackish. Disk of parafrontals of female polished metallic greenish-black, bare; that of male usually with purplish luster near vertex and thinly golden pollinose in front. Frontalia rich brownish-ocher in direct view. Antennae black, articulations obscurely rufous, or first two joints and broad base of third rufous. Palpi fulvorufous. Occiput golden-ashy, with gold-gray beard. Thorax deep polished metallic purplish-black, with golden pollen only in front, where the beginnings of a median pair of linear vittae are visible. Scutellum about same color, but faintly pollinose. Abdomen of female showing first segment purplish-black, second and third segments subopaque olive-greenish, anal segment polished metallic dark green; that of male all most highly polished except first segment, the sides broadly clear light rufous to middle of third segment, rest deep dark metallic greenish with occasional suggestions of purplish. Legs black. Wings lightly smoky, more deeply so along costal border; alulae and tegulae dilute honey-yellow, the hind scale sometimes shading to whitish on disk.

Holotype.—Cat. No. 19450, U.S.N.M., female. Allotype, male. Paratypes include TD 3953, female.

MAKASINOCERA, new genus.

Genotype.—*Makasinocera unguis*, new species.

Differs from *Archytas* as follows:

Male.—Second antennal joint longer than third. Third antennal joint extremely moccasinlike in shape as seen in profile, very strongly convex on front edge, narrowed apically. Second aristal joint very elongate, four or more times as long as wide. Cheeks three-fourths of eye-height. Scutellum with five pairs of marginal bristles, a decussate apical pair, and an erect subapical pair. Anal segment with marginal, submarginal, and discal rows of macrochaetae. Front claws fully twice as long as last tarsal joint, others nearly twice as long as same. Wings longer and narrower, the origin of apical crossvein conspicuously nearer hind margin of wing than length of hind crossvein.

The name is from the Algonkin word "makasin," commonly spelled moccasin in English. Notwithstanding that the above differences seem slight and evasive so far as putting them in words may go, this form can not possibly be referred to *Archytas* even as a subgenus.

MAKASINOCERA UNGUIS, new species.

Length of body, 13 mm.; of wing, 11.5 mm. Three males, Santa Eulalia, Peru, about 3,500 feet, on foliage, April 28, 1914 (Townsend).

Palpi fulvous, first two antennal joints rufous. Frontalia pale flavous anteriorly, rufotestaceous posteriorly. Parafrontals black, thinly silvery. Whole face and cheeks silvery-white. Occiput brassy-silvery, beard pale yellow. Thorax shining black, thinly dusted with brassy-silvery, more thickly brassy anteriorly and on pleurae. Scutellum dark shining testaceous. Abdomen dark shining rufotestaceous, a faint blackish median vitta showing. Legs blackish, front femora thickly brassy-silvery pollinose on outside. Pulvilli fuscous-yellowish. Wings evenly lightly infuscate, not yellow but deep yellowish-fuscous at base. Tegulae deeply smoky.

Holotype.—Cat. No. 19452, U.S.N.M. The two paratypes include TD 4241.

Family EXORISTIDAE.

ANEMORILLA, new genus.

Genotype.—*Anemorilla rufescens*, new species.

Differs from *Nemorilla* as follows: Female only described. Distinct facies. Hind tibiae without sign of ciliation or approach to it. Vibrissae inserted at point well removed from oral margin. Third antennal joint broad, only one and one-half times as long as the second; second joint very elongate. Frontals descending low, below base of third antennal joint. Apical cell ending a very little before wingtip. Head rather broad and shortened, parafacials narrow. Discal bristles on intermediate abdominal segments. Ovipositor fleshy, telescoped. Deposits an elongate-elliptical flattened white macrotype egg, and evidently belongs to the Exoristinae.

ANEMORILLA RUFESCENS, new species.

Length of body, 6 to 6.5 mm.; of wing, 5.5 to 5.75 mm. Two females, base of foothills near Lima, Peru, September 28, 1912, on foliage of *Nicotiana*, sp. (Townsend).

Legs, palpi, and first two antennal joints light rufous; tarsi, third antennal joint, and arista blackish. Frontalia brown. Face and cheeks pale brassy-silvery, parafrontals more distinctly pale brassy.

Thorax, scutellum, and abdomen thickly pollinose with pale brassy-silvery; mesoscutum showing four well-marked vittae, the inner pair a little narrower and shorter than the outer. Abdomen submarmorate, a median vitta and pair of large spots showing more or less distinctly on segments two and three. Wings nearly clear, only very faintly tinged with fuscous, stigma smoky-yellowish. Tegulae waxy-yellowish, the front scale whitish anteriorly.

Holotype.—Cat. No. 19454, U.S.N.M. TD 4097.

ACEMYIOPSIS, new genus.

Genotype.—*Acemyiopsis punensis*, new species.

Differs from *Acemyia* as follows: Female with four orbital bristles on each side. Cheeks of female less than one-fourth eye-height. Eyes practically bare, but furnished with very short sparse barely distinguishable hairs. Third antennal joint hardly over one and one-half times second. Arista thickened on basal fourth. Front of female as wide as eye, face conspicuously widening. Strong proclinate pair of ocellar bristles. No outer vertical bristles in female; inner ones long and not decussate, straight. Proboscis short. Eyes of female descending hardly short of vibrissae, which are removed from oral margin. Frontal bristles descend very little below base of second antennal joint. Palpi sybcylindrical, short, slightly flattened, surmounted by several strong short bristles. Two sternopleurals and three postsuturals. Scutellum with strong decussate apical pair of bristles, and two long lateral pairs. No discal macrochaetae on abdomen. A median marginal pair on first segment, and one lateral marginal. Second segment with four long median marginal, then two short bristly hairs on each side of these, then one long lateral. Third and fourth segments with marginal row of long macrochaetae. All the macrochaetae of abdomen and thorax are long, the anterior supra-alar and anterior postalar being the longest and strongest of the thorax and well curved. Claws of female as long as last tarsal joint. Apical cell very short-petiolate, ending far before wingtip.

ACEMYIOPSIS PUNENSIS, new species.

Length of body, 6 mm.; of wing, 4.75 mm. One female, Oroya, Peru, over 12,000 feet, on short herbage in Rio Mantaro Valley, March 6, 1913 (Townsend).

Black. Facial plate and parafacials frosted-silvery, parafrontals and ocellar area golden. Frontalia very dark brown. Second antennal joint and palpi clear rufous, third joint and arista black. Occiput, mesoscutum, pleurae, scutellum, and abdomen thickly pollinose with dull light golden. Four narrow thoracic vittae, the outer ones of the semicolon type. Legs black, femora and tibiae pale brassy pollinose. Wings nearly clear, faintly smoky-gray. Tegulae tawny-white, the small front scale more nearly white.

Holotype.—Cat. No. 19455, U.S.N.M. TD 4126.

OÖMEIGENIA, new genus.

Genotype.—*Oömeigenia chosica,* new species.

Runs to *Pentamyia* in Brauer and Bergenstamm's tables, but apical scutellar setae are wanting. Facialia broad, crests ciliate about or nearly halfway up with curved bristles that grow weaker in their upper extent. Eyes of female very sparsely short-hairy. Front and face of female absolutely equilateral, about one and one-fifth times eye-width. Parafacials narrowing to a line just above vibrissae. Eyes descending fully to vibrissal angles; latter closely approximated to the broad, cut-off and feebly prominent oral margin. Second antennal joint short, third reaching almost to oral margin; arista thickened on basal half, becoming abruptly hairlike near middle, basal joints very short. Proboscis short and fleshy; palpi elongate, bowed, not stout but conspicuously thickened on tips. Frontal bristles descending to base of third antennal joint, the pair opposite lunula decussate, next pair reclinate; two strong reclinate inner orbitals behind these, in line with same; two strong proclinate outer orbitals, with two or three weak proclinate ones interspersed in row with them; the strong ones not quite as strong as the anterior inner orbital, which is nearly equal to the inner vertical. Outer vertical bristle long, but weaker and shorter than inner. Strong proclinate-divaricate pair of ocellar bristles, about equaling outer orbitals. Frontalia very wide, taking up fully half the width of the front in middle. Antennae inserted well above eye-middle. Apical cell closed in margin about as far before extreme wing tip as half length of hind crossvein. Fourth vein abruptly bent at rounded angle, without stump or wrinkle. Hind crossvein nearer bend. Three strong lateral scutellar macrochaetae, and a weak short subdiscal pair. First abdominal segment with a median marginal pair of long macrochaetae; second with short weak erect discal pair hardly distinguishable from the bristly hairs, and four median marginal long macrochaetae. Third segment with four short erect median discal in transverse row, and marginal row of long strong macrochaetae; anal segment with complete transverse discal row of short erect macrochaetae, and marginal row of long ones. Three sternopleural and three postsutural bristles. Legs of moderate length; claws of middle and hind legs of female short but well developed, those of front feet distinctly vestigial, the front tarsal joints quite normal and unmodified. The genus bears no close affinity with *Meigenia,* but resembles that genus in type of reproductive habit and egg.

OÖMEIGENIA CHOSICA, new species.

Length of body, 5.5 mm.; of wing, 4 mm. One female, Chosica, Peru, April 21, 1914, on foliage (Townsend).

Blackish; parafrontals, parafacials, and ocellar area silvery-cinereous with faint suggestion of brassy; facial plate and facialia silvery-plumbeous, second antennal joint thinly silvery. Palpi yellowish-salmon color, their bases slightly infuscate; occiput plumbeous, thinly silvery. Thorax and scutellum thinly silvery, the mesoscutum with four ill-defined vittae of usual pattern. Abdomen with bases of second to fourth segments broadly silvery, the fasciae fading out gradually on their posterior borders, that on second segment narrowest. Femora very faintly pollinose. Wings clear, very faintly infuscate on costobasal portion. Tegulae pearl-tawny, the front scale more whitish.

Holotype.—Cat. No. 19456, U.S.N.M. TD 4232.

CHRYSOEXORISTA, new genus.

Genotype.—*Chrysoexorista viridis*, new species.

Female front at vertex about one-fourth of head-width, that of male nearly one-third same; proclinate ocellars present; outer vertical vestigial in male; two reclinate fronto-orbitals in both sexes, two proclinate in female. Frontals descending as low as origin of arista, three or four below base of antennae and three above. Eyes thickly hairy. Facialia bare except a few bristles next vibrissae, which are level with the flared edge of epistoma. Second antennal joint short; third reaching to the epistoma, subequilateral, a little longer in male than in female. Facial depression wide, moderately deep. Parafrontals clothed with microscopic short hairs, parafacials bare. Cheeks about one-fourth eye-height in both sexes. Proboscis short and fleshy; palpi stout, curved. Three sternopleurals; four postsuturals in male, three in female which is probably abnormal; three postacrostichals in male, four in female likewise probably abnormal; three lateral scutellars, weak apical pair and separated discal pair in both sexes. Both sexes with short median marginal pair of bristles on first and second segments, and short median discal on second and third segments; marginal row of longer and stronger ones on third segment, and marginal and discal rows on fourth. Hind tibiae of male weakly ciliate, with longer bristle; those of female weakly pectinate. Claws of both sexes equal, hardly as long as last tarsal joint. Apical cell open, ending a little before wing tip; cubitus rounded, about as far from hind margin as half length of hind crossvein, latter nearer cubitus which is without stump or wrinkle.

CHRYSOEXORISTA VIRIDIS, new species.

Length of body, 8 to 9.5 mm.; of wing, 7 to 8.75 mm. One male and one female, Casahuiri San Gaban canyon, montanya of southern

Peru, about 4,500 feet, February 4, 1910, on ground in sunny opening in woods (Townsend). The female is the larger.

In life brilliant gold-green over whole upper surface, the bright vivid green predominating, the gold represented by reflections. Dried specimens show this surface solidly obscure old-gold, broken only by the black frontalia, thoracic vittae, first segment of abdomen and hind borders of the other three segments; with the green showing in patches through the gold pollen of abdomen. Face silvery, occiput leaden-silvery, parafacials and rest of head light golden, palpi rufous, antennae and legs black; wings clear, tegulae yellowish-white. The inner pair of thoracic vittae extends well behind suture.

Holotype.—Cat. No. 19611, U.S.N.M., female. Allotype, male.

Genus BOLOMYIA Brauer and Bergenstamm.

Genotype.—*Mystacella violacea* Wulp[1] = *Exorista rufata* Bigot.

Differs from *Macromeigenia* as follows:

Male.—Front not so produced, the frontal profile much shorter, the parafacials much narrower; facial plate broadening distinctly below, not subequilateral; vertex not exceeding one-fourth head width. Eyes rather thickly hairy. Hind tibiae rather strongly ciliate, with a longer bristle near middle. Third antennal joint scarcely two and one-half to three times as long as second. Cheeks not over one-third eye-height. Thoracic, scutellar, and abdominal chaetotaxy same. Hind crossvein slightly nearer to cubitus, apical cell ending a little nearer to wing tip, cubitus somewhat nearer to margin, apical crossvein less bowed in. No discals on intermediate abdominal segments.

BOLOMYIA VIOLACEA Wulp; Brauer and Bergenstamm.

Length of body, 9.25 to 12 mm.; of wing, 8 to 10 mm. Ten males, as follows: One Sonsonate, Salvador, and seven Cordoba, Mexico, January 31 to April 8, 1908 (F. Knab); one Tucurrique, Costa Rica (Schild and Burgdorf); and one Los Amates, Guatemala, February 7, 1905 (Charles C. Deam).

Differs from Wulp's description only in showing five distinct thoracic vittae, the fifth extending full length of mesoscutum; and often no violet tint on the abdomen, but frequently patches suggestive of vivid green in life breaking through the deep golden pollen. The thorax and scutellum are rather bronze-golden. Brauer and Bergenstamm describe *violacea* as having four vittae, thorax yellow-gray, and abdomen bronze-yellow. The above males all have the black hind border of abdominal segments moderately broad. Brauer has declared *rufata* Bigot to be this species. *Eurigaster commetans* Walker may easily be this species, but type proof is needed.

A single female from Tehuantepec, Mexico (Sumichrast), differs from the above males by having discal bristles on the intermediate

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[1] Biol. Cent. Amer. Dipt., vol. 2, 1890, pp. 53-54.

abdominal segments, and may represent a distinct species. Brauer and Bergenstamm state that the macrochaetae are only marginal, and they had both sexes. The present female has the black hind borders of segments very narrow, conspicuously narrower than in the above males. Eyes are not quite so thickly hairy; hind tibiae weakly ciliate, with a longer bristle; third antennal joint about three times second, cheeks hardly one-half eye-height. Vertex a little less then one-third head-width. Otherwise as in the males.

It is evident that there are many very distinct Neotropical forms of the higher muscoid groups whose upper parts are more or less vividly gold-green in life. *Chrysoexorista* and a new genus are South American; *Bolomyia* ranges from Brazil to Mexico; *Paramesochaeta* is Mexican; while another new genus ranges from Mexico to the high boreal of northern New Mexico in the Las Vegas Range. *Macromeigenia* represents this coloration type in eastern North America.

MICROPLAGIA, new genus.

Genotype.—*Microplagia nitens*, new species.

Venation *Voria*-like. Apical cell very short-petiolate, the petiole barely distinguishable. Hind crossvein in middle between small crossvein and cubitus. Costal spine present. Head subhemispherical in profile; the front long, very flattened. Eyes bare. No ocellar bristles. Antennae short, inserted about on eye-middle, second and third joints about equal. Face short, widening from front. Parafacials with row of facio-orbital bristles, the lower ones most pronounced, the the upper ones very delicate. Arista thickened on basal fourth, with short hairs in middle. Three proclinate orbital bristles in female. Proboscis short; palpi elongate, subfiliform, hardly thickened apically. Parafacials nearly as wide as facial plate, of even width. Facialia bare. Frontal bristles descending only to base of second antennal joint. Lunula conspicuous, horseshoe-shaped. Vibrissae on oral margin. Cheeks scarcely over one-fourth eye-height in female. Front of female at vertex about five-sixths eye-width. Scutellum without apical pair of bristles, with only two long lateral pairs. Abdomen short-oval; macrochaetae very short, subhairlike, no discal, no median except pair on third and fourth segments. All segments with a lateral marginal bristle or two. Two sternopleurals, and three postsuturals. Legs short, front tarsi of female noticeably thickened. Wings short.

MICROPLAGIA NITENS, new species.

Length of body, 4 mm.; of wing, 3 mm. One female, valley in foothills a league north of Lima, Peru, on herbage, December 5, 1912 (Townsend).

Black; abdomen, pleurae, head, and legs mostly shining. Parafacials and parafrontals very thinly cinereous pollinose, facial plate faintly so. Mesoscutum and scutellum thinly ashy-silvery; former with three blackish vittae, the middle one narrower. Abdomen rather polished, showing faint trace of pollen in two mediobasal flecks on segments two to four. Extreme tip of anus testaceous. Venter very faintly silvery. Wings subhyaline; the outer or costal half lightly smoky, bounded by fifth vein and hind and apical crossveins. Tegulae watery-white.

Holotype.—Cat. No. 19457, U.S.N.M. TD 4102.

SPHALLOGLANDULUS, new genus.

Genotype.—*Sphalloglandulus unicus*, new species.

Eyes moderately thickly hairy in male, which is the only sex here described. Front on posterior half rather over two-thirds eye-width. Head quadrate and equilateral in profile, but front very prominent and occiput strongly bulged below, the long axis of eye set obliquely to occipital and facial planes. Frontal bristles descending low, the facialia ciliate to the lowest frontals. Second antennal joint elongate; the third joint about twice as long as second in male, acutely pointed on front apical corner. Arista thickened on less than basal half, second joint hardly or slightly longer than wide. Facial and frontal lengths about equal. Oral margin rather cut-off, but the epistoma distinctly projecting. Vibrissae a little removed from oral margin at sides, but nearly or quite on level with middle of same. Cheeks fully one-third of eye-height. Proboscis short, the part below geniculation hardly as long as third antennal joint; palpi stout-filiform, somewhat bent, faintly thickened apically. Three sternopleurals and three postsuturals. Scutellum with three strong laterals, but no apical pair; two shorter erect curved discal pairs, the hind pair separated. First abdominal segment with a long median marginal pair and a lateral one, second segment with median discal and marginal pairs and a lateral one, third segment with median discal pair and a marginal row, anal segment with discal and marginal rows. All segments show discal laterals. Legs not elongate, moderately stout, claws of male fully as long as last tarsal joint. Apical cell very narrowly open, ending well before wingtip, cubitus well rounded; hind crossvein sinuate, a little nearer to cubitus, nearly parallel with last course of fourth vein. Costal spine long, accompanied by a second shorter one.

SPHALLOGLANDULUS UNICUS, new species.

Length of body, 6.5 mm.; of wing, 5 mm. One male, Oroya, Peru, over 12,000 feet, May 7, 1914, on herbage in Rio Mantaro valley (Townsend).

Black, thinly silvery-ashy on sides, light golden pollinose on upper parts. Facial plate and antennae soft blackish, with faint pale golden bloom. Parafacials, parafrontals and occipito-orbits golden pollinose. Occiput ashy. Frontalia nearly black. Palpi brownish-black. Thorax with two broad heavy black vittae which reach scutellum and are continued narrowly on sides of latter. Abdomen showing light golden pollen most thickly on basal half or two-thirds of second to fourth segments. Extent of pollen visible varies with incidence of light. Venter ashy. Legs black. Wings, clear, tawny at base. Tegulae whitish, with tawny margins.

Holotype.—Cat. No. 19458, U.S.N.M. TD 4267.

Family RHODOGYNIDAE.

SIPHOPSALIDA, new genus.

Genotype.—*Siphopsalida meridionalis,* new species.

Differs from the other genera of the *Leucostoma* group by the following characters: Proboscis slender, conspicuously longer than head-height, about one and one-third times same. Reclinate ocellar bristles in female as strong as the strong fronto-orbitals and frontals; two strong verticals in female, not decussate. Lower border of head equaling or slightly exceeding frontal length. Epistoma very prominent, projecting forward. Vibrissae strong, set back from but nearly on level with oral margin. Cheeks of female narrow, the eyes descending very low. Face hardly wider than front in female. Third antennal joint longer than second. Abdominal macrochaetae very distinct, the abdomen without long erect hairs. Fourth segment glabrous, without hairs except a few short fine ones on posterior portion. First two segments with median marginal pairs of bristles, third segment with marginal row. Female forceps meeting apically at acute angle, not toothed. A short but distinct costal spine. Petiole of apical cell about as long as hind crossvein. Tegulae of normal size.

SIPHOPSALIDA MERIDIONALIS, new species.

Length of body, 5.5 mm.; of wing, 4 mm. One female, San Diego, Casma, Peru, on cotton foliage during outbreak of *Alabama argillacea,* April 7, 1912 (Townsend).

Black. Parafrontals, parafacials, and cheeks pronounced silvery-white, but with obscure reflections in certain oblique lights. Clypeus and epistoma silvery on yellowish background. Antennae blackish, with faint grayish bloom. Palpi pale yellowish. Occiput ashy. Pleurae and thorax before suture well pollinose with silvery-white. Mesoscutum behind suture and scutellum faintly silvery. Abdomen polished black, not pollinose. Legs black. Wings nearly clear. Tegulae tawny-white.

Holotype.—Cat. No. 19459, U.S.N.M., female. TD 4095.

Family PHASIIDAE.

ECTOPHASIOPSIS, new genus.

Genotype—*Ectophasiopsis chilensis,* new species.

Resembling *Ectophasia* Townsend in general appearance, form of abdomen and wings, but differing in the closed and petiolate apical cell, and the heavily ciliate hind tibiae. The genus is evidently closely related to *Trichopodopsis* Townsend, from which it may be at once distinguished by the broadly ovate and shortened abdomen of both sexes, the broad hyaline inner margin of wings, and the shorter legs, as well as the broadly yellow wing bases in both sexes. The petiole of apical cell is but little shorter than length of second antennal joint, being always pronounced. In this character the genus resembles *Mormonomyia* Brauer and Bergenstamm, but differs therefrom in other marked characters such as the form and venation of the wings, although it agrees in the form of abdomen and the ciliate hind tibiae.

ECTOPHASIOPSIS CHILENSIS, new species.

Length of body, 7 to 9 mm.; of wing, 5.5 to 7 mm. One female and two males, Chile (E. C. Reed).

Front and face silvery, with a yellowish tinge in some lights; frontalia pale brown to blackish; antennae rufous, the third joint usually black except base, the arista brown or blackish. Mesoscutum silvery pollinose in both sexes, the disk with a brassy tinge and four distinct black vittae reaching well behind suture, the outer ones heavier and all interrupted. Scutellum blackish, somewhat silvery. Abdomen of female broadly orange-yellow on sides in an evenly arcuate marking extending from front edge of first segment to hind edge of third segment, the two nearly confluent on front margin of second segment, the rest of abdomen black with a faint silvery sheen, venter wholly yellow except tip; the male abdomen is normally wholly yellow on venter including even the hypopygium, and encroaching upon the dorsum in a broad border on sides and tip, the rest being blackish with a faint silver sheen over all. In one male the abdomen is wholly yellow, with only a brownish spot on middle of fourth segment and the fourth and fifth segments more thickly silvery pollinose. Legs black or brownish, the cilia of hind tibiae glossy jet black. Wings of both sexes broadly flavous on base, broadly hyaline on inner border, the intermediate portion black, broad rays of milky white traversing the length of the wing in the male but confined to the middle subcostal region of the wing in the female. Tegulae light golden yellowish, the front scale more or less whitish externally. Pleurae thickly silvery. Claws fairly elongate in female, strongly so in male.

Holotype.—Cat. No. 19460, U.S.N.M.

Trichopoda arcuata Bigot,[1] described from Chile, may possibly be this species, but the description does not agree well with the present specimens. Brauer indicates Bigot's species with a query as a synonym of *pennipes* Fabricius.[2]

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[1] Ann. Soc. Ent. France, 1876, p. 397.

[2] Sitz. Kaiserl. Akad. Wiss., Math.-nat. Cl., vol. 107, p. 508.

A REVIEW OF SOME BIVALVE SHELLS OF THE GROUP ANATINACEA FROM THE WEST COAST OF AMERICA.

By William Healey Dall,
Curator of Mollusks, United States National Museum.

This group of bivalves contains species which are in general very similar, and often possess analogues in different faunal regions which have been confounded under a single specific name. Like most genera, when the specific characters are rigorously analyzed, the species separate into distinct groups arranged geographically in accordance with the general laws governing the distribution of mollusks.

Not a single Atlantic species of the temperate regions has so far been found on the Pacific coast of either American continent. Even the species which inhabit the western Arctic Ocean are mostly distinct from those of Greenland and Europe.

Family THRACIIDAE.

Taking up the Thracia family, we find that *Cyathodonta* is a very ancient group and species are found in the Antillean Oligocene. Typical *Thracia* seems to have come in in Eocene time. If, as claimed by Zittel, the Triassic *Corimya* of Agassiz is a *Thracia*, the group had its inception in the Mesozoic.

The earliest name for the latter is *Rupicola*, Fleuriau de Bellevue, 1802. This name, however, is preoccupied for a genus of birds, dating from 1760. Récluz[1] has described as existing between *Thracia* and *Rupicola* anatomical differences in the gills, foot, and siphon, which, if confirmed, would separate the two groups generically if not more widely. But I am unable from an examination of the literature of the subject to find satisfactory confirmation of these differences, which may have been due in the case of the Récluz specimen to mutilation or abnormality. *Ixartia* Leach, *Rupicilla* Schaufuss, and possibly *Pelopia* H. and A. Adams are synonymous with *Rupicola* Fleuriau. For the true *Thracia* Blainville, in the errata to his Manual (p. 600), restricts his group to that typified by *T. corbuloidea*, removing his division B, typified by *T. pubescens* to the genus *Osteodesma* Deshayes.

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[1] Journ. de Conchyl., vol. 4, p. 120, 1853.

The Pacific coast species have mostly been confused together, their supposed variability is largely due to confounding different species under one name. The nestling species, like *T. curta*, however, are naturally modified by their *situs*.

Genus THRACIA (Leach MS.) Blainville, 1824.

Type.—T. corbuloidea Deshayes.

(For full synonymy and discussion, see Trans. Wagner Free Inst. of Science, vol. 3, pt. 6, p. 1522, 1903.)

THRACIA CURTA Conrad.

Thracia curta CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 8, 1837. Type locality, Santa Barbara, California.

The shell, when normal, has much the shape of *T. corbuloidea* Deshayes, or *T. conradi* Couthouy, but never grows as large as the latter. It is frequently found nestling in rock cavities and borings, when young, and in such cases its general aspect conforms to the walls of the cavity, and so we have specimens simulating the profile of *Petricola, Lithophaga*, or a pholad. One such was that Conrad originally figured. The large series in the United States National Museum enables me to connect the various mutations with the normal form. This species is chalky white with a dehiscent brownish periostracum, and is densely coarsely granulose. A well grown specimen measures: Length, 53; height, 42; diameter, 22 mm.; with the vertical from the beaks falling 26 mm. in front of the posterior end. A larger fragment when complete must have measured over 60 mm. in length. I have not found a lithodesma, which perhaps is present in the young. The pallial sinus is linguiform and nearly reaches the vertical from the beaks. Cat. No. 74216*a*, U.S.N.M.

This species ranges from Icy Cape, Arctic Ocean, to Bering Strait, Plover Bay, the greater part of Bering Sea and the Aleutians, and southeast to San Diego, California. The more southern specimens do not attain the size of those from Alaska, judging by those which have been collected. The fossil *T. trapezoidea* Conrad is a more elongated shell.

THRACIA BERINGI, new species.

Thracia beringi (Dall) J. G. COOPER, Cat. shells in State Mining Bureau, 1894. (Name and distribution only. List not paginated.)

Shell of moderate size, white, with a dehiscent yellowish periostracum (usually lost), and looking much like a *Macoma sabulosa*. Valves nearly equal, nearly equilateral, with low beaks and a conspicuous external ligament enfolding the resilium. Surface with incremental irregularities and in the periostracum numerous small wrinkles, but without perceptible granulation. Pallial sinus large, rounded, not reaching the vertical from the beaks. Valves rounded at both ends, the posterior dorsal area inconspicuous, not bounded by a rib, and there is no indication of a lithodesma. Length, 35; height, 25; diameter, 12; vertical, from the posterior end, 16 mm. Maximum length 40, height 30 mm.

Distribution.—Arctic Ocean north of Bering Strait? Bering Sea and Aleutian Islands, south and east to Sitka, Alaska. (Type locality, Commander Islands.) Cat. No. 221555, U.S.N.M.

THRACIA CHALLISIANA, new species.

Shell large, chalky, subquadrate, almost equivalve, the posterior end longer, surface covered with a coarse, almost imbricating granulation, without radial elevations or defined dorsal areas. Both ends are rounded, there is no distinct posterior truncation, though that end is blunter than the anterior; resilium and ligament marginal, inconspicuous, with no indication of a lithodesma; pallial sinus wide, shallow, reaching only halfway from the posterior end to the vertical of the beaks. Length, 45; height, 33; diameter, 20; vertical from the beaks 25 mm. in front of the posterior end.

Distribution.—Type locality, San Juan Island, Gulf of Georgia. Cat. No. 272096, U.S.N.M. Also at Forrester Island, Alaska.

This species, which is allied to the fossil *T. condoni* Dall (1909), is named in honor of Miss Bertha M. Challis of the State Museum, Seattle, Washington, who has exhibited much interest in the mollusca of the region.

THRACIA DIEGENSIS, new species.

Shell very thin and small, whitish or brownish, usually with a deposit of rusty orange color about the margin; valves moderately subequally convex, the anterior end longer, the posterior end attenuated and squarely truncate; posterior dorsal area defined by a raised thread on each valve; surface smooth, except for incremental irregularities; beaks rather prominent; no perceptible granulations; hinge linear and very feeble, the resilifer not projecting; in the cavity of the beak a short line of brown matter resembling cement extends downward, which indicates the attachment of a widely V-shaped lithodesma which is usually lost; pallial sinus deep, reaching beyond the vertical of the beaks; base of valves nearly straight. Length, 9; height, 7; diameter, 4 mm.; vertical of the beaks 3 mm. in front of the posterior end.

Distribution.—Type locality, San Diego Bay, in 1 to 5 fathoms sandy mud, very abundant. Cat. No. 73604, U.S.N.M.

This little species resembles *T. fabula* Philippi, from Sicily. It is one of the few species which seem to flourish on the muddy bottom of the bay.

THRACIA COLPOICA, new species.

This is a species belonging to the same type as *T. diegensis* but larger, more rounded, with a more irregular surface; the posterior dorsal area is relatively narrower, bounded by a rib, beyond which is another more anterior rib, while in the left valve there is an obscure ray about the middle of the disk, but hardly visible in the opposite valve; at the posterior end the truncation is but obscurely indicated; the base is prominently arcuated. Length, 17; height, 13; diameter, 9 mm.; vertical of the beaks 7 mm. in front of the posterior end and barely reached by the pallial sinus.

Distribution.—Type locality, Gulf of California. Cat. No. 73639, U.S.N.M.

THRACIA SQUAMOSA Carpenter.

T. squamosa CARPENTER, Proc. Zool. Soc. London, for 1855, p. 229. Type locality, Mazatlan, Mexico.—REEVE, Con. Icon. *Thracia*, pl. 3, fig. 16, 1859.

This species has much the form of *T. phaseolina*, but the surface is densely granulose; ligament inclosing the resilium on the hinge margin; there is a vertical scar under the beaks, very large and more conspicuous than in most bivalves if, as seems probable, it denotes the attachment of the lithodesma. No lithodesma was noticed in the specimens.

Distribution.—Magdalena Bay, Lower California, to the Gulf of California. Cat. No. 15885, U.S.N.M.

Genus CYATHODONTA Conrad.

Cyathodonta CONRAD, Proc. Acad. Nat. Sci. Phila., vol. 4, p. 156, 1849. *Type.*—*C. undulata* Conrad.

CYATHODONTA UNDULATA Conrad.

C. undulata CONRAD, Proc. Acad. Nat. Sci. Phila., for 1849, vol. 4, p. 156.
C. granulosa GOULD, Boston Journ. Nat. Hist., vol. 6, p. 407, 1852, name only. Cited by Carpenter in Rep. British Assoc. Adv. Sci. for 1856, p. 231.
C. plicata CARPENTER and others, not of Deshayes.

This shell is large, elongate, with a very flat left valve and more convex right valve; the plaits are hardly oblique, and as usual are obsolescent on the part of the valve behind the anterior ray. They number 18 to 20. There are three faint rays on the left valve and two on the right. The surface is covered with minute granules definitely arranged in lines radiating from the umbones. The pallial sinus is rounded and high, reaching the vertical from the beaks, which are subcentral. Length, 48; height, 35; diameter of right valve, 10; left, 4 mm. The vertical from the beaks is 26 mm. in front of the posterior end of the valves.

Distribution.—La Paz and other localities in the Gulf of California. Cat. No. 73602, U.S.N.M.

This fine species is the largest of the West Coast species and the analogue of the *C. magnifica* Jonas, from the Atlantic coast of Honduras. Still larger single valves are in the collection.

CYATHODONTA DUBIOSA, new species.

Shell in general resembling *C. undulata* on a smaller scale. The left valve is nearly as convex as the right valve. The plaits are less regular, becoming obsolete behind and toward the basal margin. The left valve has only two very faint rays, the right valve also two, of which the dorsal one is strong. The granulation is in somewhat irregular concentric lines and not radially distributed; the pallial sinus is not so high relatively and falls short of reaching the vertical of the beaks. Length, 38; height, 29; diameter of right valve, 9; of left valve, 7.2; vertical, 15 mm. in front of the posterior end.

Distribution.—San Pedro to San Diego, California, and to La Paz, Lower California. Cat. No. 96450, U.S.N.M. Type locality, off La Paz.

The most obvious distinction between this and *C. undulata* of the same size lies in the greater relative convexity of the left valve in *C. dubiosa.*

CYATHODONTA LUCASANA, new species.

Shell small, whitish, translucent, fragile, elongate-quadrate, the anterior end longer; hinge marginal, feeble, a half-ring-shaped lithodesma in front of the resilifer; posterior end truncate, with a rounded ridge from the umbo to the basal end of the truncation; plications few and sparse; no granulation perceptible, and the sinus invisible on account of the translucency of the shell. Length, 7.5; height, 5; diameter, 3.75; vertical, 3 mm. in front of the posterior end.

Distribution.—Type locality, Cape St. Lucas, Lower California, Xantus. Cat. No. 15910*b*, U.S.N.M.

Not identical with the young of any of the other species.

CYATHODONTA PEDROANA, new species.

Shell small, white, resembling *C. dubiosa* but more pointed behind, hardly truncate, anterior end longer; valves nearly equally convex; the plaits are more numerous (±25), narrower, more close-set, and more regular, they reach the posterior dorsal margin; the rays are obscure; the granulations obscurely concentrically disposed; the sinus is small, shallow, and does not reach the vertical of the beaks. Length, 27; posterior end to vertical, 10; height, 21; diameter of right valve, 6; of left valve, 5 mm.

Distribution.—Type locality, in mud dredged from the channel of San Pedro Harbor, California. Also at Catalina Island. Cat. No. 207527, U.S.N.M.

This was quite abundant in the mud excavated by the Government dredgers, and is a particularly neat, compact, and pretty species.

CYATHODONTA GALAPAGANA, new species.

Shell small, elongate, white, the anterior end the longer; left valve rather convex, bearing a smooth narrow escutcheon, the remainder of the surface covered with very numerous (50–55) narrow, close-set, hardly oblique plaits; a single narrow ray borders the escutcheon; granulation not perceptible under an ordinary magnifier; the hinge linear, very weak; the truncation oblique, inconspicuous; the posterior end bluntly rounded below, the anterior end narrower, rounded; the umbo rather prominent; pallial sinus subquadrate, ascending, just reaching the vertical from the beak in the left valve. Length of left valve, 27; posterior end to vertical, 10; height, 18; diameter of left valve, 5 mm.

Distribution.—Type locality, near the Galapagos Islands at station 2813, in 40 fathoms, sand, dredged by Bureau of Fisheries steamer *Albatross*. Cat. No. 195029, U.S.N.M.

Only one left valve of this species was obtained.

The following unnamed Atlantic species may properly find a place here:

CYATHODONTA CRUZIANA, new species.

Shell small, thin, white, covered with a delicate straw-colored periostracum; valves unequal, moderately convex, the anterior end longer, the posterior end truncate, the whole covered with a coarse granulation irregularly, rather densely distributed; on the anterior dorsal slope of the right valve the plaits are obsolete, as they also are on the posterior dorsal area, which is not bordered by a distinct ray in front; between these areas the plaits (30–35) are continuous and fairly regular with subequal interspaces; on the anterior dorsal area of the left valve they reach practically to the margin; on this valve there are a median and a posterior obscure ray, the latter in front of the posterior dorsal area; hinge with a feeble ligament over a separate strong resilium, with a purse-shaped lithodesma in front of the resilifer; pallial sinus small, rounded, not reaching the vertical from the beaks. Length, 25; posterior end to the vertical, 10; height, 13; diameter of right valve, 6; of the left valve, 3.5 mm.

Distribution.—Type locality, near Santa Cruz Island, West Indies, in 38 fathoms at station 127; dredged by U. S. S. *Blake*. Cat. No. 64429, U.S.N.M.

This very neat little species is analogous to *C. pedroana* in the Pacific fauna.

The following forms allied to *Thracia* are known from the Pacific coast:

ASTHENOTHAERUS VILLOSIOR Carpenter, 1864.

Manuel Lagoon, Lower California, to Cape St. Lucas.

BUSHIA PANAMENSIS Dall, 1889.

Station 2805, in 51 fathoms, mud, Panama Bay, U. S. S. *Albatross*.

The following species of *Thracia* have been described from the Tertiary of the Pacific coast:

THRACIA TRAPEZOIDES Conrad, 1849.

Tertiary of Astoria, Oregon.

THRACIA MACTROPSIS Conrad, 1857.

Tertiary, Monterey County, California.

THRACIA DILLERI Dall, 1898.

Mid-Eocene, Arago beds, Oregon.

THRACIA SEMIPLANATA Whiteaves.

Eocene, Ventura County, California, according to Arnold.

THRACIA KARQUINEZENSIS Weaver, 1905.

Eocene, Contra Costa County, California.

THRACIA CONDONI Dall, 1909.

Miocene, near Eugene, Oregon.

THRACIA JACALITOSANA Arnold, 1909.

Miocene, Fresno County, California.

THRACIA VENTRICOSA Conrad,

Is a nude unidentifiable name, in Meek's Miocene Check-list, 1864.

There are species of *Cyathodonta* in the Oligocene marls of Panama, but these fossils have not yet been worked up.

Family PERIPLOMATIDAE.

Genus PERIPLOMA Schumacher.

Periploma SCHUMACHER, Essai d'un Nouv. Syst. Vers Test., pp. 40, 115, 1817. *Type.*—*P. inaequivalvis* Schumacher.

Osteodesma A, BLAINVILLE, Man., vol. 2, p. 659, 1827.

PERIPLOMA PLANIUSCULA Sowerby.

Periploma planiuscula SOWERBY, Proc. Zool. Soc. Lond. for 1834, p. 87. Isla de Muerte, Guayaquil.

Periploma lenticularis SOWERBY, Proc. Zool. Soc. Lond. for 1834, p. 87. Isla de Muerte, Guayaquil.

Periploma argentaria CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 238, pl. 18, fig. 8, 1837. California.

Periploma obtusa HANLEY, Ill. Lamarck's Shells, pl. 2, fig. 50, 1842. "West America."

Periploma alta C. B. ADAMS, Panama Shells, p. 292, 1852.

?*Periploma papyracea* CARPENTER, Proc. Zool. Soc. Lond. for 1855, p. 229. Mazatlan; not of Say, 1822.

Periploma excurva CARPENTER, Proc. Zool. Soc. Lond. for 1855, p. 229; Mazatlan.

Periploma excurvata CARPENTER, Rep. Brit. Assoc. 1856, p. 287. (Error for *excurva*.)

Distribution.—San Pedro, California, and south to Panama and Guayaquil. Cat. No. 153307, U.S.N.M.

Doctor Stearns in reviewing the West American species of the genus[1] expressed the opinion that several of the above-mentioned species are synonymous with that of Sowerby. A considerable series having accumulated in the national collection, the present writer is of the opinion that the variations exhibited, taken in connection with the fact that many years' collecting has not discovered any other species of this type in the region referred to, cover fairly well the figures of the several nominal species, and in default of typically named specimens authorize the presumption that the names cited in the synonymy represent only individual mutations of one species. Until further information to the contrary shall have been received it will be best so to consider them.

The familiar and appropriate name *argentaria*, given by Conrad, will therefore have to be retired in favor of the earlier *planiuscula* of Sowerby.

PERIPLOMA DISCUS Stearns, 1890.

Distribution.—Type locality, San Pedro Bay, California. Cat. No. 126931, U.S.N.M.

PERIPLOMA CARPENTERI Dall, 1895.

Distribution.—Type locality, Panama Bay, in 210 fathoms. Cat. No. 106891, U.S.N.M.

PERIPLOMA STEARNSII Dall, 1895.

Distribution.—Type locality, Gulf of California, in 24 fathoms. Cat. No. 110548, U.S.N.M.

PERIPLOMA (HALISTREPTA) SULCATA Dall, 1904.

Distribution.—Type locality, San Pedro Bay; Terminal Island and vicinity, California. Cat. No. 109318, U.S.N.M.

Family PANDORIDAE.

Genus PANDORA Hwass, 1795.

Subgenus KENNERLYIA Carpenter, 1864.

KENNERLYIA GRANDIS Dall, 1877.

Distribution.—This species ranges from the vicinity of the Pribilof Islands, Bering Sea, south and eastward to Siletz Bay, Oregon. Cat. No. 171069, U.S.N.M.

This is the largest species of the genus, though sometimes nearly approached by the allied *K. wardiana* A. Adams, of Japan. It is also found fossil in the Pleistocene of Santa Monica, California.

KENNERLYIA GLACIALIS Leach, 1819.

Distribution.—Arctic Sea at Point Belcher, and south to Fuca Strait. Cat. No. 73514, U.S.N.M.

This is also reported from Spitsbergen and was originally described from Greenland seas.

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[1] Proc. U. S. Nat. Mus., vol. 13, No. 813, pp. 222-224, 1890.

A variety *eutaenia* of this species with a more rostrate posterior end and averaging larger than the typical form was obtained at Port Etches and eastward at Sitka, in Alaska. Cat. No. 171062, U.S.N.M.

KENNERLYIA FILOSA Carpenter, 1864.

Distribution.—From the vicinity of Nunivak Island, Bering Sea, south and eastward to San Pedro, California. Cat. No. 4542, U.S.N.M.

KENNERLYIA BILIRATA Conrad, 1855.

+ *K. bicarinata* Conrad, 1864.

Distribution.—Forrester Island, Alaska, southward to Point Abreojos, Lower California. Cat. No. 1063, U.S.N.M.

KENNERLYIA GRANULATA, new species.

Shell closely resembling in form the *bilirata*, but much smaller, more translucent, and of a greenish tint, with the base and dorsal margins more nearly parallel and with the elevated lirae of the posterior dorsal surface delicately granulated.

Length, 8.5; height, 4; diameter, 1; beaks behind the anterior end, 1 mm.

Distribution.—Santa Barbara, California, to Guaymas, Mexico, and especially abundant at the type locality on muddy bottom in the vicinity of La Paz, Lower California. Cat. No. 211348, U.S.N.M.

This minute species is extremely common in shallow water with a muddy bottom near the end of the Lower California peninsula. It shows on the flat valve hardly any trace of the brown radiating irregular lines so common in species of this group.

KENNERLYIA CONVEXA, new species.

Shell short, deep, with a very convex left valve and a nearly semicircular outline; right valve flattish, concave near the basal margin, white, with a conspicuous velvety brownish periostracum, especially on the rostrate end; a few irregularly radiating lines on the disk; dorsal margins nearly straight, base evenly rounded, left valve slightly rostrate behind; exterior of the left valve with a few obscure slightly elevated radial lines on the disk and two posterior dorsal radial lirations. Hinge very feeble, resilium short, with a thick lithodesma; teeth in the right valve closely adjacent, small. Length, 21; height, 12; diameter, 3.5; beaks behind anterior end, 5.5 mm.

Distribution.—Type locality, Ballenas Lagoon, Lower California, in 48 fathoms. Cat. No. 171068, U.S.N.M.

This is a well-marked form, with the anterior area of the left valve not set off by an impressed line, but marked by a distinct inset at the basal margin.

KENNERLYIA PATAGONICA, new species.

Shell bearing a marked resemblance to the *K. bilirata* of the California coast; white with a dehiscent grayish periostracum; hinge line nearly straight, the posterior left dorsal margin sharply reflected outward, with two sharp radial lines below it; the surface of the disk anteriorly has a few obscure hardly elevated radial lines, with the anterior area feebly marked and only slightly interrupting the basal margin, which is evenly rounded; posterior end truncate above but hardly rostrate; right valve flat above, concave near the basal margin, with a few irregular radial impressed lines, and two grooves above, corresponding to the lirae of the opposite valve; basal curve meeting the anterior dorsal margin in a sharp angle; hinge very feeble, teeth very short, and adductor scars very small. Length, 14.5; height, 8; diameter, 2; beaks behind anterior end, 3.5 mm.

Distribution.—Type locality, west coast of Patagonia in 61 fathoms, mud; bottom temperature, 54° F. Cat. No. 96937, U.S.N.M.

This little species is surprisingly like the northern one. The only other one of the group yet found in the Patagonian region is a *Pandora.*

Subgenus CLIDIOPHORA Carpenter, 1864.

CLIDIOPHORA CLAVICULATA Carpenter, 1855.

Distribution.—From Scammon Lagoon, Lower California, to Panama. Cat. No. 15931, U.S.N.M.

Subgenus HETEROCLIDUS Dall, 1903.

HETEROCLIDUS PUNCTATUS Dall.

Clidiophora punctata (Conrad, 1837) CARPENTER, 1855.

Distribution.—Clayoquot, Vancouver Island, British Columbia, and south to the Gulf of California. Cat. No. 15794, U.S.N.M.

This species lacks the long posterior left lamina which is one of the characteristics of the typical *Clidiophora.*

Subgenus COELODON Carpenter, 1864.

COELODON RADIANS, new species.

Shell small, delicate, white, arcuate behind the beaks, compressed, with the anterior area defined by an impressed line but not interrupting the basal margin; posterior dorsal margin flat, with one sharp radial lira below its outer edge; anterior dorsal margin straight, short; surface of the valves smooth except for incremental lines, with a pale straw colored periostracum; basal margin evenly arcuate; right valve with three short diverging teeth, the central one shortest; left valve with two rather short diverging laminae with a short deck covering the angle at their junction, the resilium attached to the anterior face of the posterior tooth and carrying a thin lithodesma.

Length, 15; height, 8; diameter, 1.3; beaks behind the anterior end, 3.5 mm.

Distribution.—Type locality, near Ballenas Lagoon, Lower California, in 5½ fathoms.

Cat. No. 171053, U.S.N.M.

Carpenter thought this group, which he regarded as a genus, was confined to oriental seas, but the discovery of this species adds it to the West American fauna. It may be that the supposed specimen of *C. ceylanica*, obtained by Cuming at Muerte Island, West Colombia, and referred to by Sowerby and Carpenter, belongs to the present species, which has the disk within the pallial line marked by radiating lines.

Subgenus FOVEADENS Dall, 1915.

Hinge with two diverging teeth in the right valve the posterior longer and higher; an obscure ridge reaching to the front edge of the anterior adductor scar may represent a third tooth; in the left valve are two short teeth close together, a long lamina in front of them carries the resilium on its posterior face; the top of this lamina is grooved and from its anterior edge a deck or sheet of shelly matter unites it with the margin of the valve leaving a hollow space beneath the deck and between the lamina and the margin.

Type.—*Foveadens panamensis* Dall.

FOVEADENS PANAMENSIS, new species.

Shell thin, white, compressed, anterior dorsal margin flattened, in the right valve a marked groove below its outer edge; the disk slightly concentrically undulate, sculptured with faint incremental lines, anterior area hardly defined; anterior dorsal margin slightly convex, posterior slightly concavely arcuate; left valve with a single liration below the edge of the dorsal margin and close to it; hinge as in the subgeneric diagnosis. Length, 18; height, 11; diameter, 1; beaks behind the anterior end, 4 mm.

Distribution.—Type locality, beach at Old Panama, Doctor MacDonald. Cat. No. 252276, U.S.N.M.

Only loose valves were found of this interesting form.

Subgenus PANDORA sensu stricto.

PANDORA CISTULA Gould, 1850.

Distribution.—Patagonia, U. S. Exploring Expedition. Cat. No. 5887, U.S.N.M.

While this species was obtained, according to the original label, somewhere in the eastern part of the Patagonian archipelago, it probably extends its range also to the western part, and so the reference to it here is not out of place.

Family LYONSIIDAE.

Genus LYONSIA Turton, 1822.

Pandorina SCACCHI, Osserv. Zool., p. 14, 1833; not of Bory St. Vincent, 1824, (*Polygastrica.*)

Magdala (Leach MS.) BROWN, Illus. Conch. Grt. Britain, 1827, expl. pl. 11, figs. 1, 2, 10.

Hiatella BROWN, 1827, not Daudin, 1802.

Myatella BROWN, Illus. Conch. Grt. Britain, 2nd ed., p. 111, 1844.

Osteodesma DESHAYES, Encycl. Méth., vol. 3, p. 552, 1830, in table. *Type*—*Mya norvegica* Gmelin.

LYONSIA STRIATA Montagu.

Mya striata MONTAGU, Trans. Linn. Soc., vol. 11, p. 188, pl. 13, figs. 1, A, 1815—TURTON, Conch. Dict., p. 105, fig. 99, 1819.

Lyonsia striata TURTON, Dithyra Brit., p. 35, pl. 3, figs. 6, 7, 1822. (*Syn. ex parte exclus.*)

?*Lyonsia bracteata* GOULD (as *Osteodesma*), Expedition shells, Proc. Boston Soc. N. Hist., vol. 3, p. 218, May, 1850; U. S. Expl. Expedition (Wilkes), p. 397, pl. 35, figs. 509, *a*, *b*, 1852.

Distribution.—Shetland Islands; Arctic Sea; on the Pacific from the Aleutian Islands south to the coast of Washington. Cat. No. 213722, U.S.N.M.

On the northern coast of Europe and the British Isles occur two forms of *Lyonsia*, one of which recurs on the Pacific coast of America. One of these is the *Mya norvegica* of Gmelin,[1] after Chemnitz,[2] and is the well known *Lyonsia norvegica* of northern Europe. The other, which was first named by Montagu *Mya striata*, differs by being a thinner, smaller, and more slender shell, with the posterior dorsal margin nearly straight and more sharply truncate, while in *norvegica* it is concavely arcuate; the test is almost translucent, the form less inflated, the dorsal, and in many cases the basal edges near the margin, conspicuously compressed, the umbones nearer the anterior end; and the surface with usually a much greater profusion of adherent sand grains than in the *L. norvegica*. The differences are fairly well indicated by Turton's figures in his Conchological Dictionary (figs. 99 and 100, 1819), and, though there is more or less variation, yet no one comparing adult and well preserved specimens can well avoid noting the distinctions.

The two have been generally regarded as mere mutations of the *norvegica* type, but the presence of one and not of the other on the Pacific coast would indicate a specific distinction. The fragments remaining of Gould's type of *bracteata* indicate that it belongs with the *striata* form, though his figure is not characteristic. Middendorff's synonymy includes practically all the northern species of *Lyonsia* under one name, but his figures relate only to the following form.

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[1] Syst. Nat., vol. 7, p. 3222, 1792.

[2] Conchyl. Cabinet, vol. 10, pl. 170, figs. 1647-8, 1788.

LYONSIA ARENOSA Möller.

Pandorina arenosa MÖLLER, Index Moll. Grönl., p. 20, 1842; Beechey's Voy. to the Pacific, pl. 43, fig. 3, 1839 (not named in the text).

Lyonsia gibbosa HANCOCK, Ann. Mag. Nat. Hist., vol. 18, 1846, p. 238, pl. 5, figs. 11, 12.

Anatina striata GRAY (not Montagu), according to Hancock, Ann. Mag. Nat. Hist., vol. 18, 1846, p. 238 (not in Appendix to Ross's Voyage).

Lyonsia flabellata GOULD, Otia Conch., p. 162, 1861.

?*Lyonsia ventricosa* GOULD, Otia Conch., p. 161, 1861. N. Japan.

Osteodesma aeruginosa MIGHELS (ubi ?).

Lyonsia arenosa var. *sibirica* LECHE, *Vega* Exp., vol. 3, p. 439, pl. 22, figs. 3, 4, 1882.

Distribution.—Greenland and Arctic Sea. On the Pacific from the Arctic south to Japan and the Okhotsk Sea on the west, and to the Aleutian chain and Kadiak Island on the east. Cat. No. 223476, U.S.N.M.

This yellowish, short and solid species is well distinguished from any of the others. Leche's variety is more elongate than the normal type. A full series of the form from north Japan would doubtless make clear the identity of Gould's *ventricosa* with the Arctic species.

LYONSIA GOULDII, new name.

Osteodesma nitidum GOULD, Mex. and Cal. Shells, p. 17, pl. 15, fig. 6, May, 1851. Not *Mya* (=*Lyonsia*) *nitida* Fabricius, 1798.—*Osteodesma nitidum* GOULD, Otia Conch., p. 187, 1861. Type locality, Santa Barbara, California.

Distribution.—San Francisco Bay, California, and south to Point Abreojos, Lower California. Cat. No. 131739, U.S.N.M.

This small, slender, and very pearly species is different both in form and distribution from the preceding.

LYONSIA CALIFORNICA Conrad.

Lyonsia californica CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 20, 1837.

Distribution.—Puget Sound, Washington, and south to Todos Santos Bay and the Coronado Islands, Lower California. Cat. No. 253111, U.S.N.M.

This white and pearly species takes much the same place in the fauna that *L. coruscans* Scacchi does in the South European fauna. It is the most common species on the Californian coast and is usually more or less arcuate and very pearly. A variety with nearly cylindrical form without arcuation from San Francisco Bay has been named by me *L.* var. *haroldi* in honor of Mr. Harold Hannibal, of Stanford University, and a very thin, smaller, and translucent form from Catalina (type locality) and the Coronado Islands, with the beaks very close to the anterior end, may be called var. *nesiotes*. The latter may possibly, with more material, prove distinct. Cat. No. 206410, U.S.N.M.

LYONSIA PUGETENSIS Dall.

Lyonsia pugetensis DALL, Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 595, June, 1913.

Distribution.—Chignik Bay, Alaska Peninsula, and east and south to Puget Sound, Washington. Cat. No. 249966, U.S.N.M. Type locality near Queets River, Washington.

This is probably the largest described species of the genus. An immature specimen was used as a type for the description, because it was perfect and not eroded. It showed nothing which could be considered as a lunule or escutcheon. Adult specimens measure 52 mm. long by 28 mm. high and 16 mm. in diameter.

LYONSIA PANAMENSIS Dall.

Lyonsia panamensis DALL, Bull. Mus. Comp. Zool., vol. 43, No. 6, Oct. 1908, p. 427, pl. 18, fig. 12.

Distribution.—Type locality, Gulf of Panama, 556 fathoms. Cat. No. 110584, U.S.N.M.

This is closely allied to *L. arenosa* and to the following species.

LYONSIA FRETALIS, new species.

Shell small, thin, white, hardly pearly, subdonaciform, covered with a rather strong, smooth, brownish periostracum ornamented with sparse, distant, elevated, radial lines, about a dozen in number; beaks prominent, opisthogyrate, close to the anterior end; anterior end broadly rounded, posterior end narrower, rounded bluntly, not truncate; no lunule or escutcheon; periostracum extending slightly beyond the calcified margins; interior slightly pearly, pallial line with (for the genus) a rather well-marked sinus; hinge feeble, the resilium parallel with the margin, the lithodesma elongate-quadrate. Length, 10; height, 7; diameter right valve, 4, left valve, 3 mm.; beaks behind the anterior end, 2.5 mm.

Distribution.—Type locality, Straits of Magellan, in 20 fathoms. Cat. No. 96196, U.S.N.M.

This species has close relations with the Arctic *L. arenosa.*

I have not seen the *Anatina cuneata* of Gray, 1824, which has generally been referred by authors to *Entodesma*, but Hanley's copy of the original figure in his edition of the Index Testaceologicus, resembles a typical *Lyonsia* rather than an *Entodesma. E. chilense* Philippi which has been united with it is certainly a very different shell, as is *Entodesma pictum* Sowerby, although both were referred, in my Report on Peruvian Shells (1909), on the authority of other authors to *cuneata* Gray. The *Lyonsia patagonica* of Orbigny in the Voyage dans l'Amérique Méridionale, is from the Atlantic coast, at the Bay of San Blas, and is probably an *Entodesma;* his *L. alvarezii* from the same locality a true *Lyonsia*, but unlike either of the Pacific species. It is probable that *L. brevifrons* of Sowerby, 1834, from Ecuador, is identical with *L. cuneata* Gray. *L. malvinensis* Orbigny, is probably not a *Lyonsia* but a member of the Leptonacea.

Subgenus ALLOGRAMMA Dall.

Allogramma DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1514, 1903. *Type.*—*Lyonsia formosa* Jeffreys.

ALLOGRAMMA AMABILIS Dall.

Lyonsia (*Allogramma*) *amabilis* DALL, Proc. U. S. Nat. Mus., vol. 5, No. 2002, p. 594, 1913.

Distribution.—Type locality, off Santa Barbara Channel, California, in 534 fathoms. Cat. No. 267171, U.S.N.M.

Subgenus ENTODESMA Philippi.

Entodesma PHILIPPI, Arch. f. Naturg., 1845, vol. 1, p. 52; 1847, p. 66. *Type.*—*E. chilense* Philippi.

Philippina DALL, Moll. Porto Rico, Bull. U. S. Fish Com. for 1900, p. 498, 1901. *Type.*—*Lyonsia beana* Orbigny.

ENTODESMA CHILENSE Philippi, 1845.

Distribution.—Type locality, Chiloë Island and north to Valparaiso, Chile. Cat. No. 73609, U.S.N.M.

This is very close to *Lyonsia inflata* Conrad, the only difference I can see is that in normally developed specimens the posterior part of the shell is more patulous, flatter, and less distinctly truncate in the Chilean shell. However, a large series of both might lead to a different conclusion. As these mollusks are nestlers, the valves are usually much distorted, taking the form of their situs. *E. navicula* Adams and Reeve, of Japan, is a very similar shell.

ENTODESMA INFLATUM Conrad.

Lyonsia inflata CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 10, 1837. Guayaquil.

Lyonsia diaphana CARPENTER, Proc. Zool. Soc. London, for 1855, p. 228. Mazatlan (young shell).

Entodesma spongiophila DALL (MS.), 1866, Monterey, Cailfornia.

Distribution.—Vancouver Island to Salina Cruz, Mexico, and Guayaquil. Cat. No. 15522*b*, U.S.N.M.

These shells are usually found living in sponges or the mass of compound ascidians, and they differ from the rock nestlers in their polished smooth surface and normal shape.

ENTODESMA PICTUM Sowerby.

Lyonsia picta SOWERBY, Proc. Zool. Soc. London, 1834, p. 88. Type locality, Muerte Island, Ecuador.

This species is much the shape of *E. beana* Orbigny of the West Indies, but differs by its painting of radial black lines on the corneous ground of the periostracum.

Section AGRIODESMA Dall.

Agriodesma DALL, Proc. U. S. Nat. Mus., vol. 37, No. 1704, p. 284, Nov. 1909. *Type.—Entodesma saxicola* Baird.

ENTODESMA (AGRIODESMA) SAXICOLA Baird.

Lyonsia saxicola BAIRD, Proc. Zool. Soc. London, for 1863, p. 70. Type locality, Vancouver Island.

Distribution.—Nestling like *Saxicava* in rock crevices from Unalaska, Aleutian Islands, eastward and southward to San Pedro, California. Cat. No. 88876, U.S.N.M.

This enormous rude species, sometimes reaching nearly 6 inches in length, is by all odds the largest species of the family. The coarse horny periostracum in drying always cracks the calcareous portion of the valves and I have never seen a perfect specimen except when preserved in alcohol. Its nestling habit results in an infinite variety of distorsion. The lithodesma is very large and strong and is inserted obliquely below the dorsal margin. The varietal name *cylindracea* Carpenter was given to specimens which had grown to fit borings of *Lithophaga.*

ENTODESMA (AGRIODESMA) SCAMMONI Dall.

Entodesma scammoni DALL, Amer. Journ. Conch., vol. 7, pt. 2, p. 142, pl. 16, fig. 3, 1871.

Distribution.—Type locality, Port Simpson, British Columbia (Scammon). Cat. No. 213713, U.S.N.M.

This species differs from all the others in its brilliantly pearly interior, its oval shape, and its permanently adherent periostracum without radiating lines. Only the original specimens collected in 1865 have so far been obtained.

Genus MYTILIMERIA Conrad.

Mytilimeria CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 246, pl. 19, fig. 5, 1837. *Type.—M. nuttallii* Conrad.

MYTILIMERIA NUTTALLII Conrad.

Distribution.—Vancouver Island and south to San Diego, California. Cat. No. 74234, U.S.N.M.

It is by no means certain that this genus is properly placed here, despite its conchological characters. The little that is known of its anatomy points rather in the direction of *Verticordia.* The animal lives surrounded by a mass of spongy texture which has been referred to as "sponge," but it is possible that the substance is a consolidated mucous exudation secreted by the animal itself. Further researches are needed to settle these questions.

A NEW CRUSTACEAN, DIAPTOMUS VIRGINIENSIS, AND A DESCRIPTION OF DIAPTOMUS TYRELLI POPPE.

By C. Dwight Marsh,

Of the United States Department of Agriculture.

The species of *Diaptomus* in the United States are pretty well known, inasmuch as collections have been made and examined from practically all sections of the country. Any material addition to the number is not to be expected; hence considerable interest attaches to anything that is distinctly new. Because, too, the species of *Diaptomus* are so distinct, and in many cases have such a definite geographical distribution, it is especially important that the species diagnoses should be as exact as possible. For these reasons it seems wise to record the description of a new species recently found in Virginia, and to publish the modifications of the diagnosis of *D. tyrelli* which result from the study of specimens from new localities.

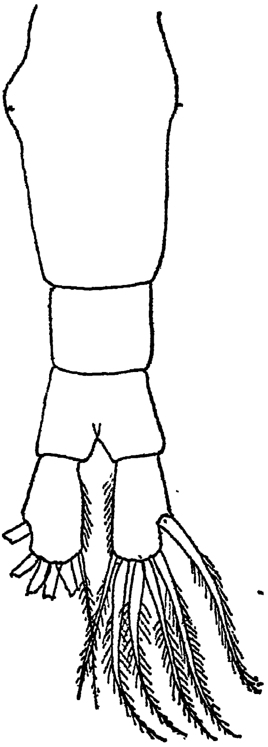

Fig. 2.—Diaptomus virginiensis. Abdomen of female, × 445.

DIAPTOMUS VIRGINIENSIS, new species.

Of moderate size. The first cephalothoracic segment is somewhat longer than the three following. The third and fourth are much shorter than the second. The last cephalothoracic segment is somewhat produced laterally, and terminates on each side in a rather acute point. About midway on the posterior border of each lateral lobe is a minute spine (fig. 1). The general form of the cephalothorax is slender, the anterior part narrow and almost pointed.

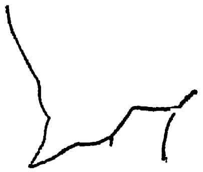

Fig. 1.—Diaptomus virginiensis. Lateral wing last cephalothoracic segment, × 445.

The first segment of the female abdomen (fig. 2) equals in length the rest of the abdomen, including the furcal rami; it is rather slender, dilated in front and laterally, the lateral dilatations not very prominent, with two minute lateral spines at about one-third its length. The second and third segments are about equal in length, and the furcal rami are somewhat longer than these segments, and are ciliate on the inner margins.

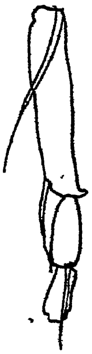

Fig. 3.—Diaptomus virginiensis. Terminal segments of antenna of male, × 445.

The antennae are 25-segmented and extend beyond the furca.

The right antenna of the male is much swollen anterior to the geniculating joint. The antepenultimate segment (fig. 3) bears a very short hook-shaped process.

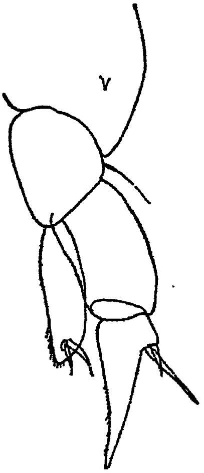

Fig. 4.—Diaptomus virginiensis. Fifth foot of female, × 875.

The first basal segments of the female fifth feet (fig. 4) are armed with rather small spines. The lateral hairs of the second basal segments are rather long and slender. The exopodite consists of two segments. The hook of the second segment is stout and denticulate on the inner margin. The outer angle of the second segment bears two spines, the inner unusually long, being about twice the length of the outer. The endopodite is 1-segmented, and is somewhat longer than the first segment of the exopodite. It is setose on the inner margin of the tip, and the tip is armed with two rather stout spines.

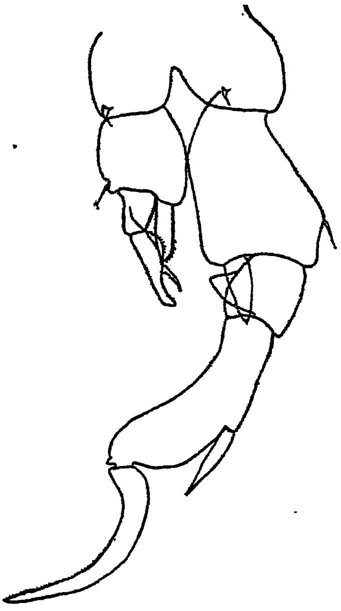

Fig. 5.—Diaptomus virginiensis. Fifth foot of male, × 445.

The spines of the first basal segments of the male fifth (fig. 5) feet are of moderate size. The second basal segment of the right foot is rather elongate, its distal end twice as wide as its proximal. The inner margin is convex, the outer straight, making a rather sharp bend near its distal end. The lateral hair is situated at about three-fourths its length. The first segment of the exopodite is about as broad as long, its inner and outer margins convex, and bears a triangular hyaline projection on its inner margin, which is continued as a shelflike projection on its posterior surface. The second segment is approximately four times as long as broad, concave on the inner margin and convex on the outer. The lateral spine is stout, about one-third the length of the segment, and situated about midway of its length. The terminal hook is much shorter than the second segment of the exopodite, is stout, and symmetrically sickle shaped. It is denticulate on its inner margin. The right endopodite is 1-segmented, triangular in shape, and about equal in length to the first segment of the exopodite. The left foot, in length, nearly reaches the end of the first segment of the exopodite of the right foot. The second basal segment is about as broad as long, the inner margin being somewhat longer than the outer. The lateral hair is near the distal angle. The first segment of the exopodite is longer than wide, the distal end being about half as wide as the proximal. The second segment of the exopodite is slender and bears on about half its inner margin a setose pad. It is terminated by a digitiform process, on the inner margin of which is a falciform, clawlike spine.

Length of female exclusive of furcal setae, 1.366 mm.

Length of male exclusive of furcal setae, 1.24 mm.

This species was found in material collected by Mr. H. K. Harring in Black Pond, Virginia.

It seems to be most nearly related to *D. birgei.*

Type-specimen.—Male Cat. No. 47892, U.S.N.M.

Paratypes, one female Cat. No. 47897, U.S.N.M., and one slide males and females, 9 specimens. Cat. No. 47893, U.S.N.M.

DIAPTOMUS TYRELLI Poppe.

1888. *Diaptomus tyrelli* POPPE, p. 150.
1889. *Diaptomus tyrelli* DE GUERNE and RICHARD, p. 39, pl. 1, figs. 17–18; pl. 4, fig. 26.
1895. *Diaptomus tyrelli* HERRICK and TURNER, p. 76, pl. 10, fig. 19.
1897. *Diaptomus tyrelli* SCHACHT, p. 176.
1907. *Diaptomus tyrelli* MARSH, p. 441, pl. 19, figs. 2, 3, and 8.
1915. *Diaptomus pribilofensis,* JUDAY and MUTTKOWSKI, p. 25, fig. 2 *a, b,* and *c;* fig. 3 *a* and *b.*

Of medium size. The suture of the first cephalothoracic segment is rather distinct. The first segment is considerably less in length than the three following. The last cephalothoracic segment is expanded into large lateral processes, each process armed with two spines.

The first segment of the female abdomen equals in length the rest of the abdomen. It is broad, dilated in front, and moderately dilated laterally. It bears prominent lateral processes which are tipped with acute spines directed backward. The second segment is shorter than the third, and the two together are somewhat longer than the furca. The furcal rami are stout and ciliate on both the inner and outer margins.

The antennae are 25-segmented and reach to the furca or to the end of the furca. The antepenultimate segment of the right antenna of the male is unarmed or has a small hyaline lamella, which may be just visible at the distal end of the segment or may extend over the distal third of the segment.

The fifth feet of the female are slender. The spines of the first basal segments are small and acute. The lateral hair of the second basal segment is of moderate length. The first segment of the exopodite is more than twice as long as wide. The hook is only slightly curved and is finely denticulate on both inner and outer margins. It is armed with three spines, the innermost being the longest. The inner two spines represent the third segment. The endopodite is long and slender, 1-segmented, and exceeds in length the first segment of the exopodite. It is setose at tip, and armed with two long terminal spines which are inserted well back from the end of the endopodite. In the male fifth feet the spines of the first basal segments are rather prominent and acute. The second basal segment of the right foot is twice as long as broad. The lateral hair is situated about at the beginning of the distal third. The first segment of the exopodite is quadrate and bears on the inner distal angle a hyaline process which varies somewhat in size and form; it most commonly has a rounded extremity but may be nearly triangular in form. The second segment is strongly curved and equals in length the first basal segment. The lateral spine is straight or slightly curved, is rather small, and is situated just distad of the middle. The terminal hook is slender, slightly curved, and equal in length to the rest of the foot with the exception of the first basal segment. It is denticulate on the inner margin. The endopodite is small, variable in length, but not as long as the first segment of the exopodite. It is ordinarily pointed at the distal extremity, but in some individuals it is rounded. The left foot reaches to the end of the first segment of the right exopodite. The second basal segment is as long as wide, and strongly convex on the inner margin. The lateral hair is situated near the distal end. The first segment of the exopodite is longer than wide. The second segment is about one-half the length of the first, and the inner surface is a convex setose pad. The segment is terminated with two digitiform processes, of which the outer is the longer. The endopodite is long and slender, reaching to the middle of the second segment of the exopodite. It is either 1-segmented or indistinctly 2-segmented. The tip is distinctly setose.

Length according to Poppe: Female, 1 mm.; male, 1.5 mm.

Length according to Lilljeborg: Female, 1.9 mm.; male, 1.8 mm.

Specimens from Alturas Lake averaged: Female, 1.258 mm.; male, 1.15 mm.

It seems probable that in Poppe's description the lengths for the female and male were transposed.

The original description by Poppe was from material collected at Summit Lake in the Canadian Rockies, at a heighth of 5,300 feet. Lilljeborg's material was from Centerville, California. It has also been found in collections made by the United States Fish Commission in Alturas Lake, Idaho, and in the Pribiloff Islands, Alaska, and by the author in Yellowstone Park and in Lake Tahoe.

The description as given above conforms very closely, as in the diagnosis given, Marsh, 1907, to the descriptions given by Poppe and by Lilljeborg in Guerne and Richard 1889. The changes are in minor additions, which are made in order to conform to the more complete knowledge of the species which is furnished by the recent collections.

In most particulars the species seems to be quite constant in its structural characters. The endopodite of the right fifth foot of the male varies in its form and length, but not within wide limits. The endopodite of the left foot is sometimes 1-segmented and sometimes 2-segmented. The spines of the second segment of the exopodite of the fifth foot of the female are, in the specimens examined by the author, much more prominent than figured by De Guerne and Richard; the innermost spine is particularly long. The variations in the armature of the antepenultimate segment of the right antenna of the male are particularly interesting. In the original description by Poppe this segment was said to be entirely unarmed. In the diagnosis of De Guerne and Richard it is said that it is "plane dearmatus, tantum modo modulo minutissimo et vix visibili praeditus." In the specimens from the Pribiloff Islands there was no armature. In those from Yellowstone Park, as shown in figure 6, there was a small hyaline lamella extending back fully one-third the length of the segment, and projecting appreciably from the distal end. In the specimens from Alturas as shown in figure 7 there is a very minute hyaline lamella at the distal end of the segment, while in the Tahoe material the armature is entirely absent.

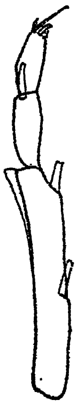

Fig. 6.—Diaptomus tyrelli. Terminal segments antenna of male from Yellowstone Park, × 445.

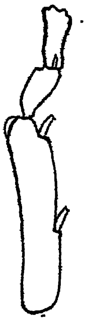

Fig. 7.—Diaptomus tyrelli. Terminal segments antenna of male from Alturas Lake, Idaho, × 445.

It appears that the Alaskan material most closely resembles the type described by Poppe. It is generally considered that the antennal armature is not subject to variation. If no variability is considered possible, the Yellowstone Park form must certainly be considered a separate species, and possibly the Alturas form another. Considerable interest attaches to just what Lilljeborg had for the description of De Guerne and Richard, the material being collected at "Centerville, near Fresno, California," and it is to be hoped that at some time a reexamination may be made of material collected from that locality.

D. coloradensis was described by Marsh in 1911 from material found in the Rocky Mountains in Colorado; it has since been found in the

Wahsatch Mountains in Utah. This is undoubtedly very close to *tyrelli*. The main points of difference as stated in the original description were as follows:

1. The spines of the first basal segments of the female fifth foot are large in *coloradensis*, small in *tyrelli*.
2. The endopodite of the female fifth foot is shorter than the first segment of the exopodite in *coloradensis*, but longer in *tyrelli*.
3. In the male fifth foot the distal margin of the first segment of the right exopodite has two hyaline processes in *coloradensis*, one in *tyrelli*.
4. The lateral spine of the second segment of the exopodite of the male fifth foot is strongly curved in *coloradensis*, but nearly straight in *tyrelli*.
5. The second segment of the exopodite of the male fifth foot has a blunt spine on the dorsal surface in *coloradensis*, but none in *tyrelli*.
6. The right endopodite of the male fifth foot is nearly as long as the first segment of the exopodite in *coloradensis*, but much shorter in *tyrelli*.
7. The left endopodite of the male fifth foot is much stouter in *coloradensis* than in *tyrelli*.

A careful reexamination of the available material shows that these points hold good except the sixth and that the endopodite of the fifth foot in the female in some specimens equals in length the first segment of the exopodite. To these may be added that the second segment of the right exopodite of the fifth foot of the male in *coloradensis* is nearly straight, while in *tyrelli* it is strongly curved and somewhat shorter and stouter. A minor point may also be mentioned that apparently in *coloradensis* the lateral spine of the second segment of the exopodite of the right fifth foot of the male turns down—that is, toward the distal end of the segment—while in *tyrelli* it turns toward the proximal end of the segment.

The distinctness of *coloradensis* then seems assured, and further study of the related forms may make it best to separate others from *tyrelli*.

D. pribilofensis Juday and Muttkowski, must, without doubt, be considered identical with *D. tyrelli*.

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NOTES ON ALLOPHANITE, FUCHSITE, AND TRIPHYLITE.

By EDGAR T. WHERRY,

Assistant Curator, Division of Mineralogy and Petrology, United States National Museum.

OBSERVATIONS ON ALLOPHANITE.

Nomenclature of the hydrous aluminium silicates.—There are among minerals a number of groups consisting of solid solutions of two or more theoretical end-compounds, in which, for convenience, certain intermediate members are assigned names. To cite one of these, the intermediate members of the plagioclase feldspar group are called oligoclase, andesine, labradorite, etc., although it would be equally possible to name them all by the proportions of the end-compounds, albite and anorthite, they contain.

While the hydrous aluminium silicates could also be named according to the proportions of the end-members present, it is perhaps better to assign names to the more important intermediate ones. Dana selected six of these: (1) halloysite, (2) cimolite, (3) montmorillonite, (4) allophane, (5) collyrite, and (6) schrötterite, as species, but of these 2 and 3 differ only in unessential particulars, as do also 4, 5, and 6, so only three are recognized here, the names assigned being those which have priority:

Cimolite (Klaproth, 1795).—Mostly soft, earthy clays with the ratio $Al_2O_3:SiO_2$ = from 1:7.5 to 1:2.5; includes anauxite, confolensite, delanovite, erinite (Thomson), hunterite, montmorillonite, razumovskite, some smectite, steargillite, stolpenite, and termierite.

Halloysite (Berthier, 1826).—Mostly soft, earthy clays with the ratio $Al_2O_3:SiO_2$ = from 1:2.5 to 1:1.5; includes ancudite, some allophane, bole, catlinite, dillnite, galapectite, glagerite, glossecollite, gummite (Breithaupt), indianaite, some kaolinite, keffekilite, lenzinite, lithomarge, meerschaluminite, milanite, nerchinskite, ochran, oropian, pholerite, pseudosteatite, samoite, severite, smectite, teratolite, and tuesite.

Allophanite (Stromeyer, 1816).—Harder, more vitreous minerals, with the ratio $Al_2O_3:SiO_2$ = from 1:1.5 to 1:0.25; includes carolathite, collyrite, and schrötterite. Only allophanite will be discussed here.

Name.—The name "allophan," from two Greek words meaning "to appear different," was given by Stromeyer[1] to a waxy, amorphous

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[1] Gel. Anz. Köng. Ges. Wiss., Göttingen, 1816, p. 1250.

PROCEEDINGS U. S. NATIONAL MUSEUM, VOL. 49—NO. 2118.

mineral containing alumina, silica, and water. In adapting German mineral names to American use the usual rule is to add *ite* to the ending *phan;* thus, leukophan, meliphan, and rhabdophan become leukophanite, meliphanite, and rhabdophanite; only *e* is added in other cases, as allophan, glaukophan, and uranophan, which are ordinarily written allophane, glaukophane, and uranophane. For the sake of uniformity, however, it seems best to have all mineral names, except those which have come down to us from the ancients, end in *ite,* so *allophanite* is adopted as the name of the substance under discussion.

Composition.—Considerable disputation has been indulged in during the last few years, chiefly by German mineralogists, as to whether allophanite and other similar minerals are variable mixtures or definite compounds. Most that has been written consists of mere quibbling over the meaning of terms; but Stremme,[1] after summing up the arguments on both sides, has shown that the noncrystalline clay-minerals are best interpreted as adsorption compounds of colloidal alumina and silica with variable amounts of water. The observations described in the following paragraph confirm the correctness of this view as far as one sample of allophanite is concerned.

A new occurrence of allophanite.—Material sent to the Museum for identification labeled as occurring "20 miles from Salt Lake City, Utah," proved to correspond in most of its properties with allophanite.[2] But its refractive index did not agree with that given in the books for this mineral (1.49), and as the exact nature of the mineral on which this value was determined is not recorded, further study of the matter seemed desirable.

The following are the properties of the sample in question:

Color: White to yellowish white.

Luster: Vitreous to dull; subtransparent.

Hardness: 3. Sp. gr.: 1.88 to 1.90.

Structure: Granular.

Fracture: Subconchoidal.

Optical properties: Isotropic (amorphous, colloidal) in large part, also showing confusedly anisotropic (metacolloidal) patches.

Index of refraction:

		Observed.	Calculated.
Saturated with H_2O (H_2O about 45 per cent)		1.465	1.466
Air-dried	40 per cent	1.480	1.473
Dried at 120°	10 per cent	1.565	1.564
Ignited	0 per cent	1.595	1.592

The calculated values were obtained as follows: The indices of the three constituents being (amorphous forms) Al_2O_3 1.68,[3] SiO_2 1.46, and H_2O 1.31, the first two were averaged in the ratio of 3:2, giving 1.592 as the index of anhydrous allophanite, and this was then averaged with the figure for H_2O in the several proportions listed. The essential agreement between the observed and calculated values indicates clearly the additive character of the indices; that is, the index of any combination is the average of the indices of its components.

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[1] Doelter's Handbuch der Mineralchemie, vol. 2, pt. 2, 1914, p. 36.

[2] Cat. No. 87438, U.S.N.M.

[3] An approximate determination on ignited $Al(OH)_3$.

Qualitative tests: Decomposed by HCl, yielding granular silica; gives reactions for Al, Ca, and traces of Mg and Fe. Before the blowpipe: Gives reactions for Al, Si, and OH.

Analysis, made on microscopically homogeneous, amorphous material:

		Ratios.	
Al_2O_3	33.78	0.331	1.0
Fe_2O_3	1.08	.007	...
SiO_2	21.70	.360	1.1
CaO	2.04	.036	...
MgO	0.45	.011	...
H_2O below 100°	4.86	.270	...
H_2O above 100°	35.82	1.990	6.0
Total	99.73		

The tendency of the colloidal alumina and silica to unite in the definite ratio 1:1 here shown is a good example of Cornu's law of homoisochemism, but the additive character of the indices of refraction of the constituents indicates that no complete chemical combination has occurred between them.

TWO NEW OCCURRENCES OF FUCHSITE.

The name fuchsite, proposed by Schafhäutl in 1842, is used to refer to the isomorphous series of which $H_2K(AlSiO_4)_3$ and $H_2K(CrSiO_4)_3$ are the end members, the first being usually present in excess over the second.

Fuchsite from Chester County, Pennsylvania.—On Young's farm, 2 miles west of Harmony Hill, on the north side of the road to Romansville, West Bradford Township, a deposit of a bright-green mineral has long been known to local mineralogists, and specimens from it included in collections, usually under the name epidote, but it was identified as fuchsite in 1907.[1] The rock consists of a fine-grained dolomite, containing considerable granular quartz, and in certain zones and streaks abundant flakes of colorless to intense green mica.[2] Although occurring only as isolated ledges in the bank of a brook, surrounded by soil containing fragments of mica schist and gneiss, and showing no determinable relations with any known formation of the region, it is probably the result of alteration of a dike of some basic igneous rock, such as chromite-bearing serpentine. A somewhat similar occurrence has been described in Montgomery County, Maryland,[1] and on excursion A 5 of the XII International Geological Congress in Canada, 1913, rocks identical in every respect with the present material were observed in connection with some of the serpentine masses in the asbestos region of Quebec.

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[1] Mineral Collector, vol. 14, 1908, p. 172.

[2] Cat. No. 87610, U.S.N.M.

The micaceous constituent of the rock can be seen under the hand lens to be partly colorless, but in certain zones it has a brilliant emerald-green color. In thin section both show the optical properties of muscovite, but the green material has in addition the intense pleochroism, greenish blue to emerald green to pale green, characteristic of fuchsite. A sample of the rock was treated with hydrochloric acid to remove dolomite and with a heavy liquid (acetylene tetrabromide, diluted with benzene) to remove the quartz. The mixture of micas, containing, as estimated with the microscope, about 10 per cent of the green variety, was fused with sodium carbonate and the chromium determined colorimetrically, the result being 0.33 per cent Cr_2O_3. The green mica therefore contains approximately 3 per cent of Cr_2O_3, or 14.4 per cent $H_2K\ (CrSiO_4)_3$.

Fuchsite from Marble, Colorado.—A specimen of a bright-green micaceous mineral was collected by Dr. George P. Merrill at the marble quarries of Colorado in 1914 and turned over to the writer for examination.[2] In his report on these quarries Doctor Merrill states:

> In the face of the cliffs between quarries Nos. 2 and 3 there occurs for a short distance a bed of white marble traversed by green veins. This is a purely local phenomenon due to the presence of a small amount of chromiferous mica and not to copper carbonate, as popularly supposed.

By dissolving out the inclosing marble with very dilute hydrochloric acid an intense green micaceous powder was obtained, which under the microscope appeared to be homogeneous and showed a most brilliant pleochroism. A sample was tested colorimetrically for chromium and 6.08 per cent Cr_2O_3 obtained, which corresponds to 29.2 per cent of $H_2K\ (CrSiO_4)_3$.

TRIPHYLITE FROM A NEW LOCALITY NEAR GRAFTON, NEW HAMPSHIRE.

The material described in this note was sent personally to Dr. George P. Merrill by Mr. L. Clough, of East Concord, New Hampshire.[3] It consists of a dull gray massive mineral with a greasy luster, showing blue films on joint planes, due to incipient alteration, and is penetrated by narrow veins of crystalline red garnet and black biotite. The locality is stated to be a mica prospect on the farm of N. M. Kilton, about 4 miles from Grafton station, several miles from the formerly famous locality of triphylite, graftonite, etc. Several hundred pounds of it were obtained.

A sample was submitted by Doctor Merrill to J. E. Whitfield for analysis and his results are given in column 1 below. For comparison

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[1] Williams and Gill, Johns Hopkins Univ. Circular No. 85, 1889.
[2] Cat. No. 88332, U.S.N.M.
[3] Cat. No. 88253, U.S.N.M.

Penfield's analyses of material from the old Grafton locality and from Norwich, Connecticut,[1] are added, in columns 2 and 3, respectively. The indices of refraction, determined by the immersion method, and the specific gravity are also compared with the corresponding values of the older material.

	1.	2.	3.
FeO	27.66	26.23	26.40
MnO	16.63	18.21	17.84
CaO	trace	0.94	0.24
MgO	2.30	0.59	0.47
Li_2O	8.49	8.79	9.36
Na_2O	0.35	0.12	0.35
K_2O	0.06	0.32	......
P_2O_5	43.85	44.03	44.76
SiO_2	0.27	....	......
H_2O	0.41	1.47	0.42
Total	100.02	100.70	99.84
Sp. gr.	3.531	3.520	3.534
α	1.690	1.688	......
β	1.690	1.688	......
γ	1.695	1.692	......
$\gamma-\alpha$	.005	.004	......
Sign	+	+	

In so far as the percentages of ferrous and manganous oxides are concerned, the present mineral is closer to that from Norwich (3) than to the old Grafton occurrence (2). Since the specific gravities in this group vary with the relative amounts of these oxides, the former yielding the higher values, the gravity of 1 might be expected to exceed that of 3. The slightly lower figure found is probably to be correlated with the relatively large amount of magnesium oxide present.

The group to which the mineral here described belongs comprises triphylite, $LiFePO_4$, lithiophilite, $LiMnPO_4$, natrophilite, $NaMnPO_4$, and the still unnamed members $LiMgPO_4$, $NaFePO_4$, $NaMgPO_4$, $KMnPO_4$, $KFePO_4$, etc. In accordance with the writer's plan for simplifying mineralogical nomenclature [2] it is recommended not only that no new names be given to the last of these, but also that lithiophilite and natrophilite be dropped.[3] Triphylite then becomes the series name, and chemical prefixes may be applied to it to refer to any desired end-member.

The mineral from the new Grafton locality may be described, accordingly, as a triphylite containing 60 per cent lithio-ferro-triphylite, 37 per cent lithio-mangano-triphylite, and small amounts of several other members of the series.

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[1] Amer. Journ. Sci., ser. 3, vol. 13, 1877, p. 425; vol. 17, 1879, p. 226.

[2] Science, new ser., vol. 39, 1914, p. 575; Proc. U. S. Nat. Mus., vol. 47, 1914, p. 504.

[3] This disregard of the "rule of priority" is believed to be justified by the gain in clearness resulting from the use of names with chemical prefixes.

BRITISH FOSSIL INSECTS.

By T. D. A. Cockerell,

Of the University of Colorado, Boulder.

INTRODUCTION.

The Lacoe collection of fossil insects, in the United States National Museum, includes a considerable series of English specimens, partly from the Lias and partly the Oligocene of the Isle of Wight, all collected many years ago by the Rev. Peter Bellinger Brodie. A study of this material has revealed many new and interesting forms, which are described herewith. There are in addition many others, some too imperfect for description; others, especially Coleoptera and minute parasitic Hymenoptera from the Oligocene, belonging to groups which I can not properly describe without larger collections of recent forms.

SUMMARY OF OCCURRENCES.

It seems useful to present a brief summary of our knowledge of British fossil insects up to the date of writing. In this I have included only the species which have been definitely named and described, as experience shows that references to species by the generic name or family name only, which are scattered through the literature, are too unreliable to be used as evidence.

Carboniferous (27 species).

Palaeodictyoptera.—Thirteen species. The family called Pteronidiae by Bolton should be written Pteronidiidae. *Pteronidia* Bolton 1912 is antedated by *Pteronidea* Rohwer 1911, but the difference of a letter should save it.

Blattoidea.—Thirteen species, seven of them described in recent years by Mr. H. Bolton.

Protodonata.—*Meganeura radstockensis* Bolton, 1914, from the upper coal measures at Radstock, Somerset.

Lias (82 species).

Orthoptera.—Nineteen species, of which three are first described below. Six are Blattoids, six Mantoids, and seven Locustoids.

Coleoptera.—Thirty-three species, of which six are first described below.

Odonata.—Eight species.

Neuroptera.—Prohemerobiidae, two species. Sialidae, one species, described below.

Panorpatae.—Four species of *Orthophlebia.*

Trichoptera.—Two species of *Necrotaulius.*

Palaeohemiptera.—Two species, one first described below.

Homoptera.—Four Fulgorid species.

Seven other species of insects have received names, but are too imperfect to place definitely in the system.

OOLITE (209 species).

Orthoptera.—Fifty-five species, of which 43 are Blattoids, 3 Phasmoids, 2 Grylloids, and 7 Locustoids.

Coleoptera.—Eighty-seven species.

Hymenoptera.—Two species of Pseudosiricidae, formerly supposed, quite erroneously, to be ants.

Odonata.—Eight species.

Neuroptera.—Four species.

Panorpatae.—Two species.

Trichoptera.—Three species of Necrotauliidae.

Lepidoptera.—Three species.

Diptera.—Eighteen species, including forms referred to Mycetophilidae, Bibionidae, Psychodidae, and Tipulidae.

Heteroptera.—Five species.

Homoptera.—Ten species, including five Fulgoridae, and a single Aphid.

Twelve other species are considered by Handlirsch to be too imperfect to be accurately classified.

The British Mesozoic insects, especially those from the Lias, are largely known from A History of the Fossil Insects in the Secondary Rocks of England, by the Rev. P. B. Brodie, published in 1845. This work contained a general account of the subject, with a number of plates drawn by Westwood, who added some critical notes, in which he included the new generic name *Orthophlebia.* There were no formal descriptions of genera or species. Brodie himself gave specific names to 32 of the insects he figured; in 1856 Giebel named 67 others; and finally Handlirsch, in his great work on fossil insects, gave specific names to 22 of those which had remained nameless, and proposed a large number of genera. Five of the species figured by Brodie received names from as many authors, namely, Westwood, Hagen, Strickland, Buckland, and Buckman. More than 30 figures still remain without names, but almost without exception they fail to show characters from which the species could be recognized.

Thus, of the 291 British Mesozoic insects, no less than 126 are figured in Brodie's work, and with a small number of exceptions are not otherwise known. Since the figures are small and not very detailed, and the specimens themselves were never very critically studied, it is clear that our knowledge of the subject is much less than the long array of generic and specific names would suggest. Of the 49 Mesozoic Blattoids, 27 were described and named by Scudder in 1886.

TERTIARY (42 species).

Coleoptera.—Two from Corfe (? Middle Eocene), named by Giebel in 1856; one from Bovey Tracey (Upper Eocene), named by Heer in 1862; one from Mundesley (Upper Pliocene), named by Curtis in 1840.

Isoptera.—Three species of *Mastotermes* described by v. Rosen, two from Gurnet Bay (Oligocene), and one from Bournemouth (Eocene).

Lepidoptera.—*Lithopsyche antiqua* Butler, from Gurnet Bay.

Odonata.—One from Gurnet Bay, described below.

Diptera.—Nineteen from Gurnet Bay, described below.

Hymenoptera.—Ten from Gurnet Bay, described below.

Homoptera.—Four from Gurnet Bay; three described below, and one by Woodward in 1879.

POST TERTIARY (8 species).

Eight species of Coleoptera, all living species, have been recorded. The total number of British fossil insects to date is accordingly 368 species, of which 44 are first described in this paper. Undoubtedly many others have been collected and await description. Brodie, in Geological Magazine, December, 1893, pages 538–540, and 1894, pages 167–169, refers to large undescribed collections from Gurnet Bay. These are now in the British Museum, and I hope to have an opportunity to describe them during the coming year.

DESCRIPTIONS OF GENERA AND SPECIES.

LIAS INSECTS.

The insect-fauna of the British Lias (lowest division of the Jurassic), as far as we know it, consists of medium sized or small species, the Coleoptera and Orthoptera being most abundant. Diptera, Lepidoptera, and Hymenoptera were apparently absent. The Coleoptera have the most modern facies, and although they doubtless all belong to extinct genera, several of the modern families were apparently already in existence. Still more remarkable is the appearance in several species of elytral stripes, representing the same fundamental pattern as we see in living beetles. The Blattoid forms, which are so conspicuous in the Paleozoic, seem to be relatively scarce and insignificant in the Lias; but later, in the Oolite, they abound. The Odonata are well established. The Lias insects come from several different localities, so their peculiarities are not likely to be due to any particular ecological conditions. It is probable that the material collected is fairly representative of the fauna, but it is very desirable to obtain a larger series of species. Should species of any of the missing orders be detected in new collections, they would be of extreme interest and value.

ORTHOPTERA.

EOSPILOPTERONIDAE, new family.

EOSPILOPTERON, new genus.

Anterior wing broad; costa straight, not elevated; apex rounded and obtuse; subcosta not far from margin, with very oblique crossveins in the costal cell; radius giving off the sector at about the end of the basal third of the wing, and shortly after that branched, and the lower division again branched, the radius thus ending as three nearly parallel veins, which enter the margin well before the apex; radial sector emitting five very oblique simple branches below; media forked a short distance before the level of the origin of radial sector, with the upper division again forked at level of origin of sector or slightly beyond; cubitus apparently simple; anal region not clearly made out. The longitudinal veins are everywhere connected by delicate vertical crossveins.

There is a general resemblance to *Zalmonites*, *Zalmona*, and *Pseudohumbertiella*, but the radius is quite distinctive. A new family seems to be indicated.

Genotype.—*Eospilopteron ornatum*, new species.

EOSPILOPTERON ORNATUM, new species.

Plate 60, fig. 2.

Anterior wing about 35 mm. long and 9.5 broad; upper apical field (in region of radius and sector) with a large round brown spot, about 3.5 mm. diameter; apical field beyond, above, and below the large spot with scattered small spots, forming a rather obscure mottling.

Lias (Brodie). Lacoe Coll. 3488. The precise locality is unfortunately unknown.

Holotype.—Cat. No. 61388, U.S.N.M.

ELCANA LIASINA (Giebel).

Plate 60, fig. 1.

English Lias, "Insect Beds" (Brodie). Lacoe Coll. 3490, 3491, 3493, 3494, 3495, the last also marked "Osborn's Pit, July, 1856." I give a figure of part of the wing of the best preserved one (3490), showing several details not before made known. This wing is about 11.75 mm. long; 3495 is a little over 13 mm. I am unable to recognize more than one species, and this is doubtless *E. liasina,* although the original figure published by Brodie shows the wing too narrow apically, and omits the middle branch of the media. The radial sector seems to have six branches, as in Brodie's figure, but close scrutiny shows a seventh branch (with branchlets) near the apex of the wing, as Handlirsch figures for *E. britannica.* According to the figure of *E. britannica,* that also lacks the middle branch of the media. *E. brodiei* Handlirsch is based on the apical half of a wing, and is probably identical with *E. liasina.* It seems probable that the three species of *Elcana* named from the English Lias can all be reduced to one.

Plesiotype.—Cat. No. 61389, U.S.N.M.

LOCUSTOPSIS LACOEI, new species.

Plate 60, fig. 4.

Anterior wing 11.25 mm. long, not quite 2 mm. broad in middle, but in apical region about 2.25 mm. broad; obscurely mottled; costal nervure reaching margin 7 mm. from apex of wing, and emitting about seven oblique branches or cross-nervures above; subcosta with a strong oblique branch just beyond end of costal nervure, but soon after closely approximated to costal margin, ending about 2.75 mm. from apex of wing; radial sector little divergent from radius, originating near middle of wing, and giving off three oblique branches; media also with three branches, which are simple; cubitus forked, but not joining media, although a rather prominent crossvein beyond the fork gives an illusory appearance of this; three anals.

Lias at Binton (Brodie). Lacoe Coll. 3460. This is smaller than the previously described species; it comes close to *L. dobbertinensis* Handlirsch, from Mecklenburg, but is smaller and differs in the details of the venation. It does not appear altogether impossible that it is identical with *dobbertinensis,* but it is probably distinct, and Handlirsch's species does not show some of the characteristic parts on which precise identification must depend. Furthermore, our insect is from the *Lower Lias,* the German one from the Upper Lias, and this alone would be almost conclusive against specific identity.

Holotype.—Cat. No. 61390, U.S.N.M.

LOCUSTOPSIS BUCKLANDI (Brodie).

Lias at Binton (Brodie). Lacoe Coll. 3461. Wing 18 mm. long, very like *L. lacoei,* but very much larger. The radial sector and media and each three-branched, as in *L. lacoei.* The character of the cubitus can not be made out. The costa, subcosta, and radius are essentially as in *L. lacoei.* The insect is a true *Locustopsis.* Handlirsch does not indicate the type of *Locustopsis; L. elegans* Handlirsch is herewith designated as such.

HAGLOPSIS BRODIEI, new species.

Plate 60, fig. 7.

Anterior wing 25 mm. long, lacking a very little of the extreme base; width in middle 7.5 mm.; apex moderately obtuse; costa straight (not convex as in Sialidae), lower margin very slightly and evenly convex; longitudinal veins throughout joined by delicate cross nervures, which are straight or slightly curved, vertical or more or less oblique. Subcosta very delicate, its very fine terminal branch ending about 10 mm. from apex of wing, where it is closely approximated to the first of the numerous oblique nervures which leave the end of the radius to join the costa; radial sector arising (leaving radius) a little more than 13.5 mm. from end of wing, and emitting four branches from its lower side; media branching about 19.5 mm. from apex of wing, the upper branch simple, the lower once branched, the fork of the lower branch at same level as separation of radial sector; between the media and the lower margin are four simple longitudinal veins, without any closed cell, the second anal curves upward basally (the anal angle of the wing being rounded) and sends a few very oblique nervures to the margin.

Lias at Binton (Brodie). Lacoe Coll. 3453.

Distinguished from *H. parallela* (Giebel) by the smaller size and the simple upper branch of media. The apex is also more pointed than in Brodie's figure of *H. parallela*.

Holotype.—Cat. No. 61392, U.S.N.M.

HAGLOPSIS PARALLELA (Giebel).

Plate 60, fig. 3.

Lias (Brodie); Lacoe Coll. 3489. A characteristic specimen, differing from the original figure in having the upper branch of the lower division of the media forked near the end. The fork of the upper division of the media is slightly over 7.5 mm. basad of the fork of the lower division. The cubitus is simple, and there are three simple anals. The radial sector shows four branches, instead of five as in the figure, but the apex of the wing is lost.

No. 3430, showing only the upper half of the wing, is referred to the same species. In it the fork of the upper division of the media is about 6.5 mm. basad of the origin of the radial sector, and the third branch of the radial sector is less than half as far from the second as the second is from the first. In 3489 the upper division of the media forks nearly 8.5 mm. basad of the origin of the radial sector, and the third branch of the sector is fully as remote from the second as the second is from the first. However, judging by analogy with living insects, these differences may well be due to individual variation For convenience of reference, 3489 may be known as variety *a* and 3430 as variety *b*.

3431, a fragment of the middle of a wing, is also referred to *H. parallela.*

Plesiotypes.—Cat. No. 61393, U.S.N.M.

CALOBLATTINA LIASINA (Giebel).

Giebel's species was evidently based on the same figure[1] as Handlirsch's *Actinoblattula brodiei.* The latter consequently falls as a synonym.

PANORPATAE.

ORTHOPHLEBIA COMMUNIS Westwood.

Plate 60, fig. 8.

This, the type of the genus, is represented by Nos. 3455, 3456, 3457, 3458, Lacoe Collection, from the Lias, the last three from Binton. The two primary branches of the radial sector fork at nearly the same level, but the upper fork is a little more basad, varying to considerably more. The anal field was not very clearly figured by Westwood, so I give a new figure (from No. 3458) showing the details. There is a rather close general resemblance to *Panorpa.* The media gives rise to four branches, of which the first is again branched; *Panorpa* has three branches, of which the first is again branched. The radial sector always has four branches leaving its upper division. In two species which Handlirsch describes from Mecklenburg there are only three such branches; this is also true of the English *O. intermedia* and *O. lata,* which appear to be identical. *O. similis* is doubtfully separable from *O. communis.* It is not impossible that all the Lias species of *Orthophletia* can be reduced to two, *O. communis* and *O. intermedia,* but it is not desirable to attempt such a reduction in the present state of our knowledge.

Plesiotype.—Cat. No. 61394, U.S.N.M.

NEUROPTERA.

NEMATOPHLEBIA, new genus (Sialidae).

Posterior wing (apparently) long and narrow, with straight costa and rounded apex; both specimens before me are longitudinally folded in the middle, and doubtless folded thus in life, after the manner of modern Sialids. Subcosta running parallel with and close to costal margin, with which it is connected by vertical (not or little oblique) cross nervures, ending a considerable distance before the apex of the wing; stigmatal region clouded, as in *Corydalis;* radius straight, ending above wingtip, quite a distance from the apex, emitting the media not very far from base, and at a very acute angle, but this angle is greater than that made by the radial sector, which leaves the radius well before the middle of the wing; radial sector with three long simple branches, the third appearing as the main stem; at the end the sector branches again, sending a branchlet obliquely downward toward the end of the third branch, this emitting four delicate V-like pairs of nervures to the margin; media straight, probably branched below, but this can not be clearly made out; anal region obscured, owing to the folding. There are crossveins at intervals, in the manner of *Corydalis*.

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[1] Brodie, Fossil Insects, pl. 8, fig. 12.

There appears to be a certain affinity with *Solenoptilon*, from the Lias of Mecklenburg, but no very close resemblance. I naturally asked myself whether the specimens could represent the hind wings of *Orthophlebia*. They are, however, evidently not Panorpoid at all, but belong to the Sialoids, and presumably to the Sialidae. The characteristic features are the folding of the wing and the unbranched first branch of the radial sector. The narrow costal cell as well as the folding appear to indicate hind wings. It seems very likely that the problematical *Orthophlebia longissima* Giebel belongs to *Nematophlebia*.

Genotype.—*Nematophlebia plicata*, new species.

NEMATOPHLEBIA PLICATA, new species.

Plate 60, figs. 5-6.

Wing about 10 mm. long; stigmatal region clouded and apical field suffusedly dusky, but no maculation; veins fuscous, delicate crossveins pallid; apical part of radius minutely speckled.

Lias; Gloucestershire or Warwickshire (Brodie). Lacoe Coll. 3478 (= type) and 3479.

Holotype.—Cat. No. 61395, U.S.N.M.

PALAEOHEMIPTERA.

MESHEMIPTERON, new genus.

Anterior wing with the apical field apparently more or less membranaceous, with delicate veins; subcosta separating from radius near or about (probably rather before) middle of wing, forming a long triangular cell with the basal angle very acute, the upper apical acute, and the lower apical obtuse; media branching about level with middle of cell in radio-subcostal fork, its upper branch widely separated from radius; cubitus simple until it reaches the apical field.

Genotype.—*Meshemipteron incertum*, new species.

MESHEMIPTERON INCERTUM, new species.

Plate 60, fig. 9.

Anterior wing as preserved 6.5 mm. long; if complete, it would perhaps be 8.5; no markings visible.

The specimen is unnumbered, but was collected by Brodie in the Lower Lias, and comes from the Lacoe collection. It is presumably related to *Dysmorphoptila*, but quite distinct. There is a marked similarity in essential structure with the Permian *Prosbole*. According to Handlirsch, the subcosta of *Prosbole* is fused with the radius, and a slight elevation running close to the upper margin is not a vein. In this insect there is a similar slight elevation or fold, which is very probably not a vein. The little cell in the fork of the subcosta and radius of *Prosbole* is represented by a large elongate cell in our insect. Upon comparison with the modern Heteroptera similar homologies can be made out. Thus *Alydus conspersus* has essentially the same type of venation, but the cell in the fork of the radius and subcosta is very large, and coalesces with the cell in the fork of the media. Hence, our insect can be regarded as intermediate in venation between *Alydus* and *Prosbole*. In our insect, as in the Palaeohemiptera and Homoptera, the veins are continuous from the basal to the apical fields, the membrane not being abruptly differentiated; nevertheless, the region of the membrane seems to have been modified, and its veins are more delicate than those on the middle and basal parts of the wing.

I was at first inclined to refer *Meshemipteron incertum* to Handlirsch's genus *Homopterites*, assuming that the figure of that insect was partly erroneous. It is not impossible that this would be correct, but we are hardly at liberty to make such an assumption, especially as Handlirsch definitely places *Homopterites* in the Fulgoridae, and seems quite clear about its characters.

Holotype.—Cat. No. 61396, U.S.N.M.

COLEOPTERA.

PROTOCUNEUS, new genus. (Rhynchophora?)

Elytron elongated, narrow at base, pointed at apex, the outer margin presenting an obtuse but salient angle far above the middle; texture dense, black as preserved, with very numerous large punctures, which are arranged in regular rows on the inner half of the elytron, but on the outer half are irregular; outer margin thickened.

Genotype.—*Protocuneus punctatus*, new species.

PROTOCUNEUS PUNCTATUS, new species.

Plate 61, fig. 6.

Elytron nearly 4.5 mm. long, 1 mm. broad at the broadest point (level with the outer angle); outer margin from angle to apex about 3.25 mm.

Lias at Wilncote (Brodie); Lacoe Coll. 3426. This is marked "Elytron of beetle, Buprestidae or Elateridae;" but I think it belongs rather to the Rhynchophora, as indicated by the large punctures and the general form. Some Curculionidæ (e. g., species of *Acalles*) have the prominent outer angle above the middle. There is also a slight suggestion of certain members of the curious Hawaiian Proterhinidae, particularly *Proterhinus kaalae* Perkins.

Holotype.—Cat. No. 61397, U.S.N.M.

ANHYDROPHILUS BRODIEI Handlirsch.

Lias (Brodie). Lacoe Coll. 3499 (Cracombe, Worcestershire), 3443, 3444, 3445, 3446, 3470 (Wainlode Cliff, Gloucestershire). Elytra about 4.75 mm. long, elongate-oval, convex, apex rather obtuse; sculpture almost lacking, but there were apparently very faint widely spaced striae. So far as anything shows, the insect could be closely allied to *Agabus*.

ELATEROPHANES SOCIUS (Giebel).

Plate 61, fig. 2.

Lias (Brodie). Lacoe Coll. 3441, 3434, 3439; all from Wainlode Cliff, Lower Lias. Brodie figured a specimen showing the thorax; those before me are elytra. They agree well with the modern Elateridae, e. g., *Monocrepidius*. There are eight longitudinal striae. The length of an elytron is 6.2 mm.

Westwood's figure, published by Brodie, actually shows the antennal grooves on the under side of the thorax, and leaves no doubt that the Elateridae were fully differentiated as early as the Lias.

Plesiotype.—Cat. No. 61400, U.S.N.M.

ELATEROPHANES ACUTUS, new species.

Plate 61, fig. 1.

Elytron 5 mm. long, about 1.5 broad in middle, as preserved dark coffee brown; striae as in *E. socius*, but faint. Compared with *E. socius*, the elytron is broader in proportion to its length and the apex is more acute. The specimen shows the inner surface.

Wainlode Cliff, Gloucestershire, Lower Lias (Bordie). Lacoe Coll. 3438.

Holotype.—Cat. No. 61401, U.S.N.M.

PSEUDOTELEPHORUS HAUERI (Giebel).

Lias (Brodie). Lacoe Coll. 3480. From the Lower Lias. In the list accompanying the specimens it is marked "Telephoridae." In addition to the very numerous fine punctures (appearing as brown dots), there are about 10 very delicate striae. The insect is evidently not closely related to *Telephorus*. (Cat. No. 61402, U.S.N.M.)

The two following species, also marked "Telephoridae" in the list, appear to belong to the same genus. The striae are delicate and not sharp, and the minute punctiform brown markings seem to be the bases of hairs, not true punctures. They may have been pigmented spots, such as occur in the Erotylidae.

PSEUDOTELEPHORUS PUNCTULATUS, new species.

Plate 61, fig. 4.

Lias (Brodie). Lacoe Coll. 3496. Preserved portion of elytron 7.5 mm. long (actual length probably a little over 9 mm.); width in middle 3 mm.; striae delicate, about 10; apex moderately acute. Larger and broader than *P. haueri*, with the outer margin more convex.

Holotype.—Cat. No. 61403, U.S.N.M.

PSEUDOTELEPHORUS GRANDIS, new species.

Plate 61, fig. 3.

Lias (Brodie). Lacoe Coll. 3497. Visible part about 11 mm. long, the total length would be about 12; striae obscure. A narrow (width in middle not quite 4 mm.) parallel-sided elytron, with a shallow sulcus next to outer margin. The base is distinctly narrower than the middle.

Holotype.—Cat. No. 61404, U.S.N.M.

PHANEROGRAMMA, new genus (Tenebrionidae?).

Elytron moderately elongate, convex, rather obscurely rugose, with five raised keellike lines; the first straight and delicate, parallel with and close to the sutural margin; the second delicate and faint, about equally remote from the first and the third, failing below; the third and fourth beginning very close together near the humeral angle, gradually diverging, curved, bending mesad; the fifth faint and incomplete.

Genotype.—*Phanerogramma heeri*, new species.

PHANEROGRAMMA HEERI (Giebel).

Plate 60, fig. 10.

Akicera heeri GIEBEL, Ins. Vorw., 1856, p. 310.
Akicera frauenfeldi GIEBEL, Ins. Vorw., 1856, p. 310.

Giebel's names were based on Brodie's figures.[1] They evidently refer to the same species, and Brodie's figure 15, on the same plate, shows the elytra in place. Giebel thought they were Orthoptera (genus *Akicera* Serville), and Handlirsch suggests that they may be femora of some Locustoid. Neither of these authors had specimens, and actual examination of one (Lias, Binton, collected by Brodie, Lacoe Coll. 3452) indicates that it is a Coleopterous elytron. It is about 5 mm. long, and the delicate rugosity is most pronounced in the middle line between the longitudinal keels. There appears to be no reason why the genus should not belong to the Tenebrionidae.

Plesiotype.—Cat. No. 61405, U.S.N.M.

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[1] Hist. Foss. Ins., pl. 8, figs. 17, 18.

HOLCOPTERA SCHLOTHEIMI (Giebel).

Plate 61, fig. 7.

Lias (Brodie). Lacoe Coll. 3484. A characteristic elytron, about 6 mm. long, differing from the type only in having the inner discal stripe reaching the base. There is a distinct sutural stripe. Neither striae nor punctures can be seen.

Plesiotype.—Cat. No. 61406, U.S.N.M.

HOLCOPTERA GIEBELI (Handlirsch).

Holcoelytrum giebeli Handlirsch certainly does not require a separate generic name. It is very close to *H. schlotheimi*, but larger, with four longitudinal color-bands on the elytron instead of three.

HOLCOPTERA CONFLUENS, new species.

Plate 61, fig. 8.

Elytron 5 mm. long and about 1.3 wide; similar to *H. schlotheimi*, but smaller and more slender, with the two principal discal bands confluent except at base, or sometimes slightly separated subapically. There is sometimes a faint and slender fourth band next to the outer margin.

Lias (Brodie). Lacoe Coll. 3482 (=type), 3483, 3498. Exact locality not given, but the first two, at least, are from the Lower Lias, as is *H. schlotheimi* (3484). Westwood considered *Holcoptera* to be probably related to the Carabidae, remarking that he knew an Indian species with similar markings. One is also reminded of certain species of *Lebia*, as *L. furcata*. The pattern is also suggestive of species of *Bidessus*.

Holotype.—Cat. No. 61407, U.S.N.M.

GLAPHYROPTULA ANGLICA, new species.

Plate 61, fig. 5.

Length 4.5 mm., elytra 3.5; width of elytron in middle 1 mm. or a very little more; outer margin of elytra obtusely subangulate (in *Chrysobothris* fashion) 2 mm. from base; no sculpture visible; humeral angle prominent, extending far beyond thorax.

Lower Lias, Gloucestershire or Warwickshire (Brodie). Lacoe Coll. 3475. This seems to be clearly a small Buprestid. The genus was based by Handlirsch on a similar but considerably larger species described by Heer from the Lower Lias of Switzerland.

Holotype.—Cat. No. 61408, U.S.N.M.

GLAPHYROPTULA LIASINA (Giebel).

The *Ancylocheira liasina* of Giebel, based on a figure (pl. 10, fig. 1) in Brodie's work, is to be referred to the same genus. It is considerably larger than *G. anglica*, and has the angle on outer margin of elytra nearer the apex.

OLIGOCENE INSECTS.

All the Oligocene material before me comes from a single locality, Gurnet Bay in the Isle of Wight. According to the labels on the specimens, this locality belongs to the Bembridge series, but J. W. Taylor[1] refers it to the Osborne series. J. Starkie Gardner[2] spells the name Gurnett Bay, but on page 36 of the same work he writes Gurnet Bay, recording *Sequoia couttsiae* Heer from the locality. Handlirsch[3] places the Gurnet Bay deposit in the Lower Oligocene, along with that of Aix in Provence and the Baltic Amber. I have not been able to determine any species as identical with those of Aix or Baltic Amber. Compared with the amber fauna, that of Gurnet Bay seems more decidedly temperate, with less suggestion of an oriental or Australian facies. There is, however, the genus *Mastotermes*, now known only from Australia. Kurt von Rosen,[4] when recording these termites, speaks of the Gurnet Bay limestone as Middle Oligocene, having apparently received this information from the British Museum. It is necessary to learn more about the Gurnet Bay fauna before expressing any positive opinion, but it seems possible that it is later than the amber.

The preservation of the specimens is most remarkable, as Brodie long ago pointed out. There was absolutely no compression, and when the rock is fractured so as to bisect an insect longitudinally, a cast of its internal organs is presented, as shown in plate 65, fig. 7, A. Many minute insects were preserved without losing their more delicate parts, as is shown by a mosquito wing still carrying the scales. The preservation was indeed similar to that of the amber insects, with the important practical difference that the medium is entirely opaque. There was perhaps a mud spring, with heated waters, into which the insects fell, possibly overcome by gaseous emanations. The waters were not themselves poisonous, as they were full of mollusks, and many of the insect-bearing fragments of rock carry also multitudes of a species of Phyllopod Crustacean, which is, I believe, the *Branchiopodites* described by Woodward.[5] It would be difficult to exaggerate the importance of this extraordinary deposit for an understanding of the Oligocene life of England, and it is very much to be hoped that more will shortly be learned about it, and more of the materials collected will be described.

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[1] Monograph Land and Freshwater Mollusca British Islands, pt. 7, 1900, p. 411.

[2] Monog. British Eocene Flora, vol. 2, pt. 1, 1883, p. 4.

[3] Die Fossilen Insekten, p. 677.

[4] Trans. Second Entomological Congress, p. 321.

[5] Quart. Journ. Geol. Soc., Lond., vol. 35, 1879, p. 346.

HYMENOPTERA.

PHILOPONITES, new genus (Philanthidae).

Allied to *Philoponus* Kohl, but differing by the less produced, more broadly truncate marginal cell, the second submarginal extremely broad below, the first recurrent nervure curved and bent backward above, and the oblique transverso-median. The first recurrent nervure reaches the second submarginal cell before the end of the first third; the second recurrent reaches the third submarginal no great distance before the middle. The second submarginal is greatly narrowed above, and the third transversocubital has a double curve. There is a rather close resemblance to the American Miocene genus *Prophilanthus* Cockerell, but there are important differences in detail, e. g., in *Prophilanthus* the marginal cell is nearly as in *Philoponus*, and the third submarginal receives the second recurrent nervure near the base.

Genotype.—*Philoponites clarus*, new species.

PHILOPONITES CLARUS, new species.

Plate 64, fig. 2.

Anterior wing about 6.3 mm. long, hyaline, with brown nervures, and large dark brown stigma. The following measurements are in μ: Breadth (depth) of stigma, about 240; greatest breadth (depth) of marginal cell, 480; marginal on second submarginal, 320; marginal on third submarginal, 720; lower side of marginal beyond third submarginal, 320; second submarginal on first discoidal, 320; second submarginal on third discoidal, 800; third submarginal on third discoidal, 448; lower side of third submarginal beyond third discoidal, 592; second discoidal cell on median, 80.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7620.

The names *Philoponus* and *Acolpus* applied (Kohl, 1889; Vachal, 1893) to the modern genus are both preoccupied (*Philoponus* Thorell, 1887; *Acolpus* Jayne, 1883). Kohl suggests that perhaps the name *Pseudoscolia* Radoszkowski may be available.

Holotype.—Cat. No. 61409, U.S.N.M.

ANEURHYNCHUS CONSERVATUS, new species (Diapriidae).

Plate 64, fig. 1.

Male.—Length about 2.5 mm.; anterior wings about 2.5 mm. long, broad and ample, with the stigma about equally distant from base and apex; hind wings relatively short, narrow, 1120 μ long and about 192 broad, the margin ciliate; antennae long, the three joints which can be seen (a considerable distance from base) much longer than wide; head rather small, in lateral profile very broad oval; hind coxae very stout, about 225 μ long and 160 broad; periole of abdomen 416 μ long, slender; second dorsal segment 672 μ long; portion of abdomen beyond second dorsal 432 μ long. There is no basal cell in front or hind wings, the basal nervure being absent; the stigmatic vein is quite long (96 μ), with a distinct knob; the very faint venation of the apical half of the wing is like that of *Cinetus*,[1] but the insect is not closely allied to *Cinetus*, being certainly a Diapriid of the subfamily Spilomicrinae. The reference to *Aneurhynchus* is necessarily more or less provisional, but there are no evident grounds for proposing a new generic name.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7642. It is interesting to find such a minute and delicate insect well preserved.

Holotype.—Cat. No. 61410, U.S.N.M.

The following eight species are all ants.

PONERA HYPOLITHA, new species.

Plate 64, figs. 3–4.

Represented by the middle of the wing, showing thick dark veins, the venation as in modern *Ponera*. The following measurements are in μ: Length of first submargined cell, 1,600; length of first section of marginal nervure, which runs vertically down from middle of stigma, 400; length of upper side of first discoidal cell, 800; length of second submarginal cell, 1,040; median cell on second discoidal, 640. The second submarginal cell comes to a point above.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7671 (type). On same piece of rock as *Necropsylla anglica*. In *Euponera succinea* Mayr from Baltic Amber the lower basal corner of the first discoidal cell is much more produced, and comes much nearer to the base of the second discoidal. A hind wing (7527), 5 mm. long, is referred to *P. hypolitha*, as it has the *Ponera* venation, and the appearance of the nervures is similar.

Holotype and paratype.—Cat. Nos. 61411, 61412, U.S.N.M.

DOLICHODERUS BRITANNICUS, new species.

Plate 65, figs. 6–7.

Female.—Anterior wing about 6 mm. long, as preserved faintly reddish, with pale ferruginous venation, except the subcosta, which is dark; stigma long and narrow; base of marginal cell vertical, and level with end of second submarginal, the latter narrowed to a point basally, where it meets the upper apical corner of first discoidal; first discoidal quadrate, longer than high, not narrowed above, not nearly reaching the transverse median. The following measurements are in μ: Transverse median nervure to basal corner of first discoidal cell, 448; length of discoidal cell, 560; length of second submarginal cell, 880; length of marginal cell, 1,760.

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[1] Ashmead, Bull. 45, U. S. Nat. Mus., pl. 14, fig 6.

Venation of hind wings ordinary for the group. Epinotum rounded; petiole formed as in modern *Dolichoderus*, as also the gaster.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7578, and its reverse 7641 (type). I also refer here 7584, although the first discoidal cell is longer. This specimen is preserved as a lateral section, showing the body cavities. The petiole, here seen in lateral profile, agrees with *Dolichoderus*. A very similar species is *Dolichoderus obliteratus* (*Hypoclinea obliterata* Scudder) from the Tertiary at Quesnel, British Columbia.

Holotype and paratype.—Cat. Nos. 61413, 61414, U.S.N.M.

DOLICHODERUS ANGLICUS, new species.

Plate 65, fig. 8.

Female(?).—Anterior wing 5 mm. long to base of stigma, total length probably about 8 mm.; venation differing from that of *D. britannicus* as follows: Second submarginal cell petiolate above, not reaching marginal, and also failing to reach first discoidal. The following measurements are in μ: Transversomedial to basal corner of first discoidal cell, 640; length of first discoidal, 1,120; length of second submarginal, 1,440.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7610. This is considerably larger than the last and differs in the venation, so it probably represents a distinct species.

Holotype.—Cat. No. 61415, U.S.N.M.

DOLICHODERUS OVIGERUS, new species.

Plate 65, fig. 9.

Female.—Length about 6.75 mm.; anterior wing about 5.25 mm., hyaline, with ferruginous nervures. Structure, including petiole, essentially as in *D. britannicus*, from which it may not be distinct, but the second submarginal cell goes beyond the base of the marginal, and fails to reach the first discoidal. The following measurements are in μ: Transversomedial to basal corner of first discoidal cell, 480; basal nervure on first discoidal, 464; basal nervure on first submarginal, 208; first submarginal on first discoidal, 640; base of second submarginal to apical corner of discoidal, 144; length of second submarginal, 928; width of second submarginal at apex, 320. Anterior femur about 1,200 μ long; hind femur long and slender, 1,920 μ long and 272 broad. The abdomen contains an eggshell, 432 μ long, so perfectly preserved that I wondered whether it could have come from some modern insect; but it appears to be part of the fossil, along with numerous indications of the internal tissues.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7630.

Wheeler records nine species of *Dolichoderus* from Baltic Amber.

Holotype.—Cat. No. 61416, U.S.N.M.

LEPTOTHORAX GURNETENSIS, new species.

Plate 65, figs. 4–5.

Anterior wing about 2.6 mm. long; venation nearly as in modern *Leptothorax canadensis*, but transversomedial nervure much more remote from lower end of basal nervure; first discoidal cell very small. measurements in μ: Upper end of transversomedial to lower end of basal nervure, 400; lower side of first discoidal, about 145; length of submarginal cell, 672.

Variety *a*: First discoidal cell larger, its lower side 200 μ. Probably an individual variation.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7546; var. *a*, 7604 (Cat. No. 61418, U.S.N.M.). This seems to be a *Leptothorax*, but I have only the wings to judge from.

Wheeler records five species of *Leptothorax* from Baltic Amber. The variety *a*, with larger discoidal, and submarginal cell narrowly truncate at end, may possibly be a distinct species.

Holotype.—Cat. No. 61417, U.S.N.M.

OECOPHYLLA ATAVINA, new species.

Plate 64, fig. 7.

Female.—Length 5.5 mm.; the long petiole and short broad abdomen as in *Oecophylla;* anterior wing slightly over 7 mm. long; stigma long and slender, marginal cell very narrow; submarginal cell, which is 1,890 μ long, narrowly truncate at end; greatest depth of submarginal cell 800 μ; basal nervure considerably longer (450 μ) on submarginal than beyond, its lower section only 320 μ (reversing the condition in *O. perdita*); lower end of basal nervure 720 μ from transvasomedial.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7560, and the reverse 7569.

Holotype.—Cat. No. 61419, U.S.N.M.

OECOPHYLLA PERDITA, new species.

Plate 64, figs. 5–6.

Female.—Anterior wing 12.75 mm. long; venation essentially as in *O. atavina*, except that the basal nervure has its lower section longest and the submarginal cell is pointed at tip. The following measurements are in microns: Upper section of basal nervure (on the submarginal), 640; lower section of basal nervure, 880; lower end of basal nervure from transversomedial, 1,760; greatest depth of submarginal, 1,520.

Female.—Variety *a* (probably an individual variation). Wing about 11 mm. long; base of stigma to base of wing nearly 7.5 mm., submarginal cell narrowly truncate at end. (The difference in the end of the submarginal, between this and the type, is not likely to be specific, as I have found a similar difference, though less marked, between the opposite sides of an example of *Camponotus noveboracensis* Fitch.) Measurements in microns: Upper section of basal nervure, 560; lower section of basal nervure, 640; lower end of basal nervure to transversomedial, about 1,600; greatest depth of submarginal, 1,360; terminal truncation of submarginal cell, 160; depth of marginal cell just above end of submarginal, 512.

Male.—Anterior wing 7 mm. long; venation as in the female, submarginal cell pointed at end. The small head with very large eyes indicates *Oecophylla* and not *Camponotus*. The male is referred to this species because it is of the size to be expected, and agrees in the wing-structure.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7526 (type); var. *a* 7550 (on same piece of rock as the type of *Protoberis*); male, 7529.

Holotype and paratypes.—Cat. Nos. 61420–61422, U.S.N.M.

OECOPHYLLA MEGARCHE, new species.

Plate 65, figs. 1–3.

Female.—Anterior wing 20.5 mm. long; venation as in the other species; upper section of basal nervure longest (upper about 1,360 μ, lower about 910); submarginal cell 6.4 mm. long, pointed at end; marginal cell 6.1 mm. long, and 670 μ deep at level of end of submarginal; lower end of basal nervure 2.5 mm. from transversomedial. The two sections of the basal nervure being essentially in a straight line in this and the other species, these can be readily distinguished from *Dryomyrmex;* the direction of the transversomedial distinguishes them from *Mycetosoritis*, etc.

Lower wing (on another piece of rock) slightly over 16 mm. long; the venation is shown in the figure. Another specimen shows the head and anterior part of body; the mandibles are long and massive, only feebly denticulate. The head is about 3 mm. wide.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7525 (type), 7568, and 7623. At first sight this seems to be a *Camponotus*, but the venation of the hind wing is different, and everything appears to indicate that *megarche, perdita,* and *atavina* all belong to *Oecophylla*, which has two species in Baltic Amber.

Holotype and paratype.—Cat. Nos. 61423–61425, U.S.N.M.

Heer in 1850 described a *Formica obesa*, which consisted of two types, *F. obesa radobojana* from Radoboj and *F. obesa oeningensis* from Oeningen. The Radoboj insect was shown by Mayr in 1867 to belong to *Oecophylla* and is to be known as *Oecophylla obesa.* The Oeningen ant, of which three examples from the University of Zürich (Heer's collection) are before me, is evidently not an *Oecophylla*, but from the general build and appearance should be called *Camponotus oeningensis.* It has priority of place over *C. heracleus* (Heer), which is possibly its male.

HOMOPTERA.

NECROPSYLLA ANGLICA, new species (Psyllidae).

Plate 63, fig. 5.

Lower half of wing (all that is visible) hyaline, with the media, cubitus, and wing-margin very dark brown; anal nervure evanescent, not colored. Cell in fork of media 448 μ long on upper side, stem of media from separation of cubitus to fork 560; cubitus from separation of media to fork 240 μ, length of cell in fork of cubitus 560 μ. What can be seen of the venation exactly agrees with the American Miocene genus *Necropsylla* Scudder; it is also similar to the living genus *Paurocephala* Crawford.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7671.

Holotype.—Cat. No. 61426, U.S.N.M.

PSYLLA (sens. lat.) EXHUMATA, new species (Psyllidae).

Plate 63, fig. 6.

Female.—Anterior wings about 1.5 mm. long; broad and obtuse, dark brown; *Rs* turned upward at end; upper branch of media nearly in a straight line with stem; cell in forks of media 320 μ long on upper side; cell in forks of cubitus elongated, about 528 μ long, the lower branch vertical; stem of cubitus (from media to fork) 208 μ; a vertical line through middle of wing at about level of middle of cell in forks of cubitus measures 176 μ from cubitus to media, 128 from media to radial sector, 160 from radial sector to costal margin. Caudal segment of abdomen greatly elongated, 528 μ long, and 50 wide near apex.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7619. The caudal end is like that of the living *Psylla floccosa* Patch. The cell in the forks of cubitus is like that of species of *Aphalara,* and the dark wings also indicate that the species is not a *Psylla* in the restricted sense. What can be seen of the structure of the head, with convex front and large prominent eyes, accords well with *Aphalara,* though not with all species of that genus. On the whole, a definite reference to a restricted modern genus seems unwarranted, although there is nothing tangible on which to establish a new generic name.

The Psyllidae of the Florissant Miocene (three genera and four species) have all had to be referred to apparently extinct genera.

Holotype.—Cat. No. 61427, U.S.N.M.

SCHIZONEURITES, new genus (Aphididae).

A minute form related to *Schizoneura* or *Eriosoma;* beak very short, four-jointed; media leaving radius at a point very remote from cubitus (I follow A. C. Baker's nomenclature of the venation), its stem very strong and distinct, the upper branch strongly divergent from the stem, which is in a straight line with the lower branch; upper branch of media simple; cell between media and cubitus strongly contracted apically (toward wing margin); anal present; costal cell large. The apical part of the wing is obliterated in the type. Among Scudder's Florissant genera this falls closest to *Schizoneuroides*, but is easily distinguished by the great distances between the bases of media and cubitus.

Genotype.—*Schizoneurites brevirostris*, new species.

SCHIZONEURITES BREVIROSTRIS, new species.

Plate 63, fig. 7.

Length about 1.2 mm., anterior wing about 1.4 mm.; beak stout 200 μ long, the comparatively slender terminal joint 53 μ long; wings clear, with dark veins; distance from base of cubitus to base (origin from radius) of media about 384 μ; origin of media to origin of radial sector about 160 μ; origin of media to fork 112 μ.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7542.

Holotype.—Cat. No. 61428, U.S.N.M.

DIPTERA.

CULEX PROTOLEPIS, new species (Culicidae).

Plate 62, fig. 1.

Represented by the apical half of a wing, with portions of the abdomen and the thorax. The specimen is remarkable in that it preserves the linear wing-scales, which appear light ferruginous and exactly like those of modern *Culex*. The venation, made out from the rows of scales, is as in modern species. The fork of the second vein (base of second marginal cell) is 672 μ from apex of wing and 480 μ from base of submarginal cell, at which point the second vein is distinctly bent. The width of the wing at level of base of submarginal cell is about 830 μ. The species is readily known from *C. petrifactellus* by its larger size.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7551. It thus appears that in the structure of the wings, at least, *Culex* was fully developed as far back as the Lower Oligocene, and has not progressed since that time. Another specimen, representing a larger species, is placed on record because it shows the proboscis, antennae, etc., although the wings are not preserved.

Holotype.—Cat. No. 61429, U.S.N.M.

CULEX PROTORHINUS, new species.

Plate 62, fig. 2.

Male.—Shows the thorax, head, and abdomen in lateral view; the end of the abdomen and most of the head destroyed. Parts of the plumose antennae show that these organs were fully developed in the males, as they are to-day. The thorax is fully 2 mm. long (that of *C. protolepis* is scarcely 1.40 mm. long). The proboscis, formed as in the modern species, is about 1,920 μ long; the dorsal aspect of the thorax before the scutellum (i. e., the prescutum and scutum) is 1,470 μ long; the very prominent scutellum is 400 μ high. The depth of the abdomen is 720 μ, and the first two long segments are each about 960 μ long.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll., no number.

Holotype.—Cat. No. 61430, U.S.N.M.

Another *Culex* from Gurnet Bay (No. 7549) shows a wing about 4 mm. long, with reddish scales on the costa as in *C. protolepis*, but the rest of the wing denuded. The venation is obscure, but the marginal cell is at least 640 μ long, probably more, and the base of the submarginal cell seems to be about 640 μ basad of base of marginal. It may be a distinct species, but it is probably *C. protolepis.* It appears to be too small for *C. protorhinus.* The width of the wing about middle is 880 μ (Cat. No. 61431, U.S.N.M.).

CULEX PETRIFACTELLUS, new species.

Plate 61, fig. 12.

Wing as preserved about 2.5 mm. long, but the base is lacking; when complete it would probably be 2.8 mm. The venation is not very clear, but enough can be seen to place the insect in *Culex* (s. latiss.), where it is remarkable for the narrow wings and very small size. The following measurements are in μ: Width (depth) of wing, 640; base of fourth posterior cell basad of level of second marginal, 1,120; length of second marginal, 560; length of fourth posterior to end of upper side, 1,010; to end of lower side, 640. The only striking feature discernible in the venation is the great distance between the bases of the second marginal and fourth posterior cells, a distance greater than the width of the wings; a condition like that found in *Anopheles punctipennis.*

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7620. On a small piece of rock, about 44 mm. long, with *Philoponites*, etc.

Holotype.—Cat. No. 61432, U.S.N.M.

PALTOSTOMOPSIS, new genus (Blepharoceridae).

Small flies with venation resembling in general that of *Paltostoma*, but differing as follows: Basal cell not visible in the specimen, which shows the wing to a short distance beyond the base, it must therefore be reduced in the manner of *Hammatorhina;* cubitus single, and no anal vein. The costa is neither thickened nor bristly; the lower margin has fine equal bristles with black bases; in *Bibiocephala grandis* I find exactly the same bristles with black bases, except that they are much closer together and unequal in size. I can detect what seem to be indications of the characteristic Blepharocerid folds, but it is not certain that these are genuine.

Genotype.—*Paltostomopsis ciliatus*, new species.

PALTOSTOMOPSIS CILIATUS, new species.

Plate 62, fig. 4.

Wing as seen (without extreme apex and base) 4 mm. long, if complete it would be about 5 mm.; hyaline, with brown veins. *Rs* slightly, but not much, bent where it gives off the upper branch, the latter straight, not so long as lower branch; if upper branch of *Rs* were produced downward to the lower margin of wing it would meet the end of the media; distance between end of media and end of cubitus 1,520 μ; end of cubitus to the rounded anal angle of wing 1,840 μ.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7522. A portion of the abdomen can be seen and appears normal for the family.

In spite of its antiquity this is a highly specialized genus.

Holotype.—Cat. No. 61433, U.S.N.M.

MYCETOPHILA VECTENSIS, new species (Mycetophilidae).

Wing 3 mm. long; veins all dark brown, very distinct; a brown shading along the veins, and apex of costal cell and region of radius infuscated, but no definite large dark spots. No subcostal nervure visible, merely a slight brown shade at base of costal cell, the condition essentially as in the living *M. anomala* Johannsen, which the fossil also resembles in the spotless wings, and the cubital fork being far proximad of the fork of the media and also proximad of the base of the *R–m* crossvein. Costal cell very narrow, its width about level with the cubital fork being 80 μ; *Rs* curved downward apically. The following measurements are in μ: Level of fork of media, which is same level as origin of *Rs* from *R* (apparent crossvein), to end of *R*, about 1,280; media from crossvein to fork, 176; level of fork of cubitus basad of level of fork of media, 252. Two delicate anal veins visible.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7620. On small piece of rock with *Philoponites*, etc. Certainly close to the lving *M. anomala.*

Holotype.—Cat. No. 61434, U.S.N.M.

SCIARA GURNETENSIS, new species (Mycetophilidae).

Wing about 3.4 mm.; characters perfectly normal for the genus. Cell in fork of media formed about as in the living *S. neglecta* Johannsen, its length (to the upper apical corner) somewhat greater than the stem of the media. The following measurements are in μ: Length of apparent crossvein (considered to be base of *Rs*) from *R* to *Rs*, 50;

distance from apparent crossvein to end of *R*, 1,150; distance from apparent crossvein to base of wing, about 1,280; distance (vertical) between upper side of cell in fork of media and *Rs*, 304; stem of media before fork, about 1,440; fork of media to end of M_{1+2}, 1,600; fork of media to end of M_3, 1,090; wing margin between ends of Cu_1 and Cu_2, 720.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7,620. On small piece of rock with *Philoponites*, etc. This may possibly be identical with one of the species described by Meunier from amber; but, if so, this can not be demonstrated. The amber species are separated mainly on antennal characters. In *S. gurnetensis* the radius ends distad (though not much) of the fork of the media, throwing the species in the group of *S. splendida*, *errans*, and *villosa*. The wings of these three species have not been precisely described.

Holotype.—Cat. No. 61435, U.S.N.M.

SCIARA LACOEI, new species.

Plate 62, fig. 6.

Eyes large and prominent, about 96 μ across, the diameter of face between the eyes about 80 μ; wings ample, about 1.5 mm. (more precisely, 1,600 μ) long and 640 μ wide (deep), pale reddish, with the veins very pale yellowish; fork of media invisible, only the ends of the branches seen, the whole vein being extremely faint, as in various living species; radius (first vein) and Cu_1 ending at same vertical level, halfway between base and apex of wing; *Rs* ending 160 μ from level of apex of wing, its course, as also the rather long and narrow anal field, as in the living *S. prolifica* Felt; apparent crossvein between *R* and *Rs* (really base of *Rs*) 480 μ from base of wing and 320 from end of *R*.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7651. Easily known from *S. gurnetensis* by the much smaller size. 7583 (Gurnet Bay) is another example of *S. lacoei*.

Holotype.—Cat. No. 61436; U.S.N.M.

SCIARA PROTOBERIDIS, new species.

Plate 62, fig. 7.

Length about 2.2 mm.; wings 2 mm. long, faintly dusky; venation normal for the genus, except that the cell in the forks of the media is greatly contracted apically (a tendency to be contracted may be seen in certain living species, as *S. impatiens* Johannsen); stem of media before fork obsolete, or so faint that it can not be detected in the fossil; apparent basal continuation of radial sector perfectly straight. The following measurements are in μ: Base of wing to end of *R*, 1,200; apparent crossvein (base of *Rs*) from *R* to *Rs*, about 28 long and 352 from end of *R*; end of Cu_2 about 1,280 from base of wing, and 430 from end of Cu_1; width of cell in forks of *M* at widest part 160, near apex only 104; distance from lower side of cell in forks of *M* to nearest part of Cu_1 about 160.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7550. Just above the wing of the type of *Protoberis obliteratus*.

Holotype.—Cat. No. 61437, U.S.N.M.

TIPULA LIMIFORMIS, new species (Tipulidae).

Plate 61, fig. 11.

Represented by the middle of a wing; close to *T. limi* Scudder, from Florissant (Miocene). The wing must have been 21 or 22 mm. long, resembling *T. limi* in the dusky suffusion along the cubitus and slight dusky spot at origin of *Rs*, also in the nearly parallel upper and lower sides of basal end of discal cell, the veins of discal and fifth posterior cells forming a cross, and the fifth posterior somewhat contracted apically. The base of first marginal cell is 3 mm. basad of apex of second basal. The following measurements are in μ: Second basal on discal, 480; second basal on fifth posterior, 1,680; fifth posterior on wing margin, 1,360.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7523.

Holotype.—Cat. No. 61438, U.S.N.M.

ATARBA VECTENSIS, new species (Tipulidae).

Plate 61, fig. 10.

Wing a little over 5 mm. long, hyaline, with a large dark cloud (as in *A. pleuralis* Williston) in the marginal cell, and radius basad of marginal cell darkened for some distance. Stem of *Rs* straight, except for a slight curve at its origin; *Rs* two-branched; anterior crossvein well developed; four posterior cells; end of second basal cell level with basal corner of discal cell (as in *A. picticornis* Osten Sacken). The following measurements are in μ: Humeral crossvein to origin of *Rs*, 2,128; origin of *Rs* basad of vertical level of basal corner of discal cell, 240; *Rs* from origin to first branch, 672; first basal cell on submarginal, 112; first basal on first posterior, 96; discal on first posterior, 336; discal on second (morphologically second and third) posterior, 96; discal cell on third (morphologically fourth) posterior, 176; discal cell on fourth (morphologically fifth) posterior 672; truncate end of second basal, 288. The subcosta runs extremely close to the radius, and ends in the costa at a very acute angle; the crossvein to radius can not be made out.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7513. This appears to agree well with *Atarba*, but it might nearly as well go in *Rhamphidia*. The divergence of the branches of *Rs* suggests *Rhamphidia flavipes* Macquart, but in *Atarba pleuralis* this is even more extreme. It is probably not a generic character, though

Needham makes use of it in his key in Report of New York State Entomologist for 1907, page 247. In Scudder's fossil species of *Rhamphidia* from Florissant the branches of *Rs* run parallel, as in *Atarba picticornis*.

Holotype.—Cat. No. 61439, U.S.N.M.

BIBIODITES, new genus (Bibionidae).

Small flies with nearly the venation of *Bibiodes*,[1] but the third vein is confluent with the fourth for only a short distance. Legs long and slender, but the anterior femora much thickened; thorax long, rather flattened, scutellum small but prominent. The fourth vein branches at the level of the stigma, as in *Bibiodes halteralis* Coquillett.

Genotype:—Bibiodites confluens, new species.

BIBIODITES CONFLUENS, new species.

Plate 62, fig. 3.

Length 5 mm. or a little over; wings clear, with large dark stigmatic spot, which is about 3 mm. from base of wing; costa with minute bristles; the strong veins, under a microscope, are seen to be transversely barred, exactly as in modern *Bibio*; confluence of third and fourth veins 160 μ, from point of separation to fork of fourth 1,040 μ; middle tibia about 1,200 μ long; measurements of hind leg in μ, tibia 1,840, first joint of tarsus 800, second joint 400, third 320, fourth 240 fifth 320. The apical part of the wing is missing, and the end of the anterior tibia can not be seen. The venation below the fourth vein is too obscure to make out.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7624. This might be treated as a subgenus of *Bibiodes*, but it is less specialized than the modern flies, and may be better regarded as the type of an extinct genus. The structure and appearance indicate that it belongs to the Bibioninae, not to the Scatopsinae. At the same time, it is impossible to demonstrate a second basal cell, the delicate veins of this part of the wing being wholly obliterated.

Holotype.—Cat. No. 61440, U.S.N.M.

PSYCHODA PRIMAEVA, new species (Psychodidae).

Plate 62, fig. 5.

Wing about 3 mm. long and 1 mm. broad, obtusely pointed, faintly yellowish, without markings, veins pale; thorax dark brown. R_1 strongly curved upward before the middle of the wing, and then nearly straight; R_{2+3} with a stem 512 μ long between the upward curve of R_1 and the fork; R_3 from its separation from R_2 to margin 1,440 μ; fork of media about 1,200 μ from base of wing; M_3, from fork to wing margin, 1,440 μ. The end of R_3 is 320 μ basad of level of tip of wing, end of R_5 40 μ basad of same level, end of M_2 480 μ basad of same level.

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[1] Melander, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 339.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7576. The rather pointed wingtip and general appearance indicate the reference to *Psychoda*, though R_5 does end distinctly below the wingtip. The species is much larger than the *Psychoda* and *Pericoma* described by Meunier from Baltic amber.

No. 7517 (Gurnet Bay) is also *P. primaeva*.

Holotype.—Cat. No. 61441, U.S.N.M

PROTOBERIS, new genus (Stratiomyidae).

Abdomen elongated, parallel-sized, exactly as in *Beris*, with seven very distinct segments showing. The rock is broken in such a manner as to leave only the abdomen and a wing, but the basal segment of abdomen shows no sign of overlapping spines, and the insect was probably without them, as is the living *Allognosta*. Wings long, extending about 1.5 mm. beyond abdomen; costoapical region dark, much as in *Acanthina;* only part of the venation can be made out, but evidently the discal cell was long, probably as long as in *Xylomyia;* the rather long praefurca certainly does not emit the second vein (as it does in *Beris*), this must have arisen further on, as in *Allognosta* and *Chorisops;* the anterior crossvein, instead of being vertical as in *Beris*, is strongly oblique, seeming to be a branch of the fourth vein; the third vein is arched at end, reaching the margin at a very acute angle near the end of the wing, and emitting some distance before an only moderately oblique upper branch.

Genotype.—*Protoberis obliteratus*, new species.

PROTOBERIS OBLITERATUS, new species.

Plate 63, fig. 1.

Abdomen black, 5.2 mm. long and 1.8 wide. Wing about 8 mm. long, dusky, costoapical region dark fuliginous. The following measurements are in μ: Length of praefurca, 560; length of anterior crossvein, 160; length of anterior branch of third vein, 320; anterior branch of third vein to end of lower branch, about 1,120; fork of third vein to upper branch of fourth (vertically), 720; upper branch of fourth to lower branch, at same level, 640.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7550.

Holotype.—Cat. No. 61442, U.S.N.M.

STRATIOMYS BRODIEI, new species (Stratiomyidae).

Plate 62, fig. 8.

A species of the type of *S. chamaeleon* Linnaeus, with large triangular lateral markings on abdominal segments, the pale triangles on the first segment about twice as broad laterally as on the second; abdomen about 5 mm. long and 4 broad, shaped as usual in the genus. Wings clear, with brown veins, which are (so far as visible) as usual in the genus. The discal crossvein is oblique, its upper end more basad, rather in the fashion of *Chrysochlora;* its length is about 160 μ. The discal cell is hexagonal, with three veins entering it and three leaving it; the following measurements are in μ: Length of discal cell, 670; width (depth) of cell, 432; face on third posterior cell, 304; face on fourth posterior, 320. (In the living *S. potamida* and *S. furcata* the face or side bordering third posterior is distinctly longer than that on fourth.) Length of wing about 8 mm., but the exact length is uncertain, the apex being invisible.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7507. Other specimens, with the same history, and labeled 7510, 7520, 7586, 7505. This is the oldest known *Stratiomys;* it shows that the color pattern has come down practically unchanged from the Lower Oligocene.

Holotype.—Cat. No. 61443, U.S.N.M.

EPHYDRA OLIGOCENA, new species (Ephydridae).

Wing about 3 mm. long; costa and second vein dark brown and thick, the other veins pallid; costa with minute black bristles, not larger above the costal cell than elsewhere; costa slightly interrupted at end of costal cell; costal cell narrow, its depth only 96 μ, the first vein curved, not at all bent; second vein with a slight upward curve, but perfectly straight at end; second basal cell confluent with discal; anterior crossvein 432 μ from base and 624 from upper apical corner of discal (plus second basal) cell; end of discal cell oblique, 192 μ from corner to corner; a short distance beyond the end of discal cell a vertical line run upward across the wing will find the first posterior cell 288 μ deep, the submarginal 240, and the marginal 144; the sides of the first posterior are here almost exactly parallel, but those of the second posterior rapidly diverge.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7509. Larger than *E. sepulta*, with end of discal cell conspicuously oblique, the lower corner more apicad. Aldrich[1] has figured the venation of several species of *Ephydra* from photographs. In *E. hians* Say the end of discal cell is very oblique, with the lower corner more basad, exactly reversing the condition in *E. oligocena.* In *E. millbrae* Jones it is less oblique; but in *E. gracilis* Packard it is somewhat oblique, with the lower corner more apicad, approaching the condition of *E. oligocena.*

Holotype.—Cat. No. 61444, U.S.N.M.

EPHYDRA (sens. lat.) SEPULTA, new species (Ephydridae).

Plate 63, fig. 2.

Wing about 2.5 mm. long, hyaline, with pale brown veins, costa with numerous short intensely black bristles or spinules; anal margin of wing straight, not convex, so that the anal field is not nearly twice as broad (deep) as the discal cell; costa continued to apex of wing, which is obtuse; antennae small, normal for the group; thorax moderately convex above. In the following description of the wing the measurements are all in μ: Costal cell very acutely pointed at apex, where there is apparently no enlarged bristle; lower side of marginal cell at apex straight, the cell extending to near the end of the wing as in modern *Ephydra;* sides of submarginal cell essentially parallel, the cell 160 deep at level of end of discal cell, and 208 deep at level of end of its upper side; first posterior cell slightly contracted apically, its depth at level of end of discal cell 208, but near apex 176; anterior crossvein 96 long, placed 576 from end of discal cell, and only about 272 from its base on upper side, though about 400 from its base on lower side, which, however, includes the confluent second cell; discal cell 144 broad at apex and 112 broad (deep) at level of crossvein; lower side of discal cell perfectly straight, except the basal 160, which bulges downward, marking the perfectly confluent second basal cell.

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[1] Journ. New York Ent. Soc., vol. 20, 1912, pls. 7, 9.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7512. This differs from typical *Ephydra* by the smaller anal field, and the crossvein nearer the base of the discal cell, more as in *Parydra*, *Hydrellia*, etc.

On the same piece of rock is a *Mycetophila*, too imperfect for description.

Holotype.—Cat. No. 61445, U.S.N.M.

HIPPELATES BRODIEI, new species (Chloropidae).

Wing about 1.8 mm. long, broad, hyaline, costa almost straight, apex very obtuse, anal area broad; the costa shows fine bristles. Anterior crossvein considerably beyond middle of discal cell; second basal cell wholly confluent with discal. The following measurements are in μ: End of marginal cell on costa about 1,090 from base of wing, and 592 beyond end of costal cell; at end of marginal cell is a minute brown spot; end of marginal cell 560 basal of level of tip of wing; width of first posterior cell at apex about 240; submarginal on first basal, 240; length of first basal cell about 480; anterior crossvein to base of marginal cell, 416; first posterior on discal cell, 224; length of discal cell, including confluent second basal, about 640; second posterior on axillary, 400.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7643. So far as anything shows, this is a perfectly ordinary *Hippelates;* considering its minute size, its preservation is remarkable. Of course the characters of the legs, used to define the genera of this family, can not be made out; nor is it possible to see the antennae.

Holotype.—Cat. No. 61446, U.S.N.M.

SPHAEROCERA SEPULTULA, new species (Borboridae).

Plate 63, fig. 3.

Wing about 1.8 mm. long, broad, grayish, with dark veins, except the second, which is perfectly colorless; thorax convex in lateral profile. This is referred to *Sphaerocera* on account of its general appearance; the form of the costal cell; the long second vein with a gentle curve, the convexity wholly upward; the discal cell narrow apically; the anterior crossvein before middle of discal cell; the second posterior cell (only base visible) rapidly broadening from the base; and the large anal or axillary field without evident veins. In addition, although the head is very obscure, two large bare black bristles project in front, and are apparently the aristae, which are large and conspicuous in *Sphaerocera.* The costa has fine short black bristles; the costal region above the costal cell is well preserved, but whatever armature there may be is concealed. The following wing-measurements are in μ: Tip of costal cell basal of vertical level of end of third vein, 1,216; apex of discal cell basal of vertical level of end of third vein, 832; width of discal cell at apex, 80; anterior crossvein to end of discal cell, 480; to base of discal cell about 208.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7539.

Holotype.—Cat. No. 61447, U.S.N.M.

STENOMYITES, new genus (Ortalididae.)

Minute flies, referable to the subfamily Richardiinae, or perhaps to the Ulidiinae; wings of ordinary shape (not narrow and elongated as in *Eumetopia*); auxiliary vein widely separated (160 μ at level of basal corner of marginal cell) from first, running a straight course to costa, with which it imperceptibly merges, as in *Macrostenomyia;* second basal and anal cells certainly very small, not visible in the specimen, which does not show extreme base of wing; marginal cell a little broader beyond middle than at end, the end a little narrower than that of first posterior (all this essentially as in *Eumetopia*); first basal cell shorter than in many genera, but seeming shorter than it really is, owing to the loss of extreme base of wing; discal cell long.

Genotype.—*Stenomyites fuscipennis,* new species.

STENOMYITES FUSCIPENNIS, new species.

Plate 63, fig. 4.

Wing with a large apical dark fuscous cloud, much as in *Eumetopia,* and with a broad rather oblique cloud before the middle; other parts of the wing are more or less marked with brown, but this is indistinct. The following measurements are in μ: Marginal cell on first basal, 400; greatest width (depth) of marginal cell, 256, and its width at apex 240; width of first posterior cell at apex, 288; discal cell on first posterior, 800; end of discal cell, 240.

Oligocene at Gurnet Bay (Brodie). Lacoe Coll. 7620. On small piece of rock with *Philoponites*, etc.

Holotype.—Cat. No. 61448, U.S.N.M.

ODONATA.

MEGALESTES(?) ANGLICUS, new species.

Plate 61, fig. 9.

Part of basal half of wing preserved, colorless, with dark veins; origin of median sector to origin of nodal sector about 7 mm.; width (depth) of wing at level of origin of nodal sector about 5 mm.; venation, so far as visible, essentially as in the Indian genus *Megalestes*,[1] differing, however, in the much greater length of the cell in fork at origin of median sector, this cell being about as long as the ones immediately apicad of it. The cells between the nodus and origin of nodal sector are more numerous than in *Ortholestes*, and agree very exactly with the condition in *Megalestes major* Selys. The zigzag lower sector of triangle is also unlike *Ortholestes*, but agrees with *Megalestes*. The condition at the base of the subnodal sector is unlike that of *Lestes* or *Ortholestes*, but agrees with *Megalestes*, except for the fact that the distance from the origin of the sector to the first crossvein is about as long as the crossvein.

Oligocene at Gurnet Bay, Isle of Wight (Brodie). Lacoe Coll. 7632.

Holotype.—Cat. No. 61449, U.S.N.M.

EXPLANATION OF PLATES.

PLATE 60.

FIG. 1. *Elcana liasina* (Giebel).
2. *Eospilopteron ornatum*, new species.
3. *Haglopsis parallela* (Giebel).
4. *Locustopsis lacoei*, new species.
5. *Nematophlebia plicata*, new species. Details of venation.
6. *Nematophlebia plicata*, new species.
7. *Haglopsis brodiei*, new species.
8. *Orthophlebia communis*, Westwood.
9. *Meshemipteron incertum*, new species.
10. *Phanerogramma heeri* (Giebel).

PLATE 61.

FIG. 1. *Elaterophanes acutus*, new species.
2. *Elaterophanes socius* (Giebel).
3. *Pseudotelephorus grandis*, new species.
4. *Pseudotelephorus punctulatus*, new species.
5. *Glaphyroptula anglica*, new species.
6. *Protocuneus punctatus*, new species.
7. *Holcoptera schlotheimi* (Giebel).

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[1] Needham, Proc. U. S. Nat. Mus., vol. 26, pl. 51, fig. 7.

FIG. 8. *Holcoptera confluens*, new species.
9. *Megalestes ? anglicus*, new species.
10. *Atarba vectensis*, new species.
11. *Tipula limiformis*, new species.
12. *Culex petrifactellus*, new species.

PLATE 62.

FIG. 1. *Culex protolepis*, new species.
2. *Culex protorhinus*, new species.
3. *Bibiodites confluens*, new species. *a*, part of wing; *b*, vein, much magnified; *c*, profile of head and thorax; *d*, front leg.
4. *Paltostomopsis ciliatus*, new species. *A*, hind margin of wing; *B*, hind margin of wing of *Blepharocera grandis*, for comparison.
5. *Psychoda primaeva*, new species.
6. *Sciara lacoei*, new species. *A*, wing; *B*, head.
7. *Sciara protoberidis*, new species.
8. *Stratiomys brodiei*, new species. Discal cell. (No. 7507.)

PLATE 63.

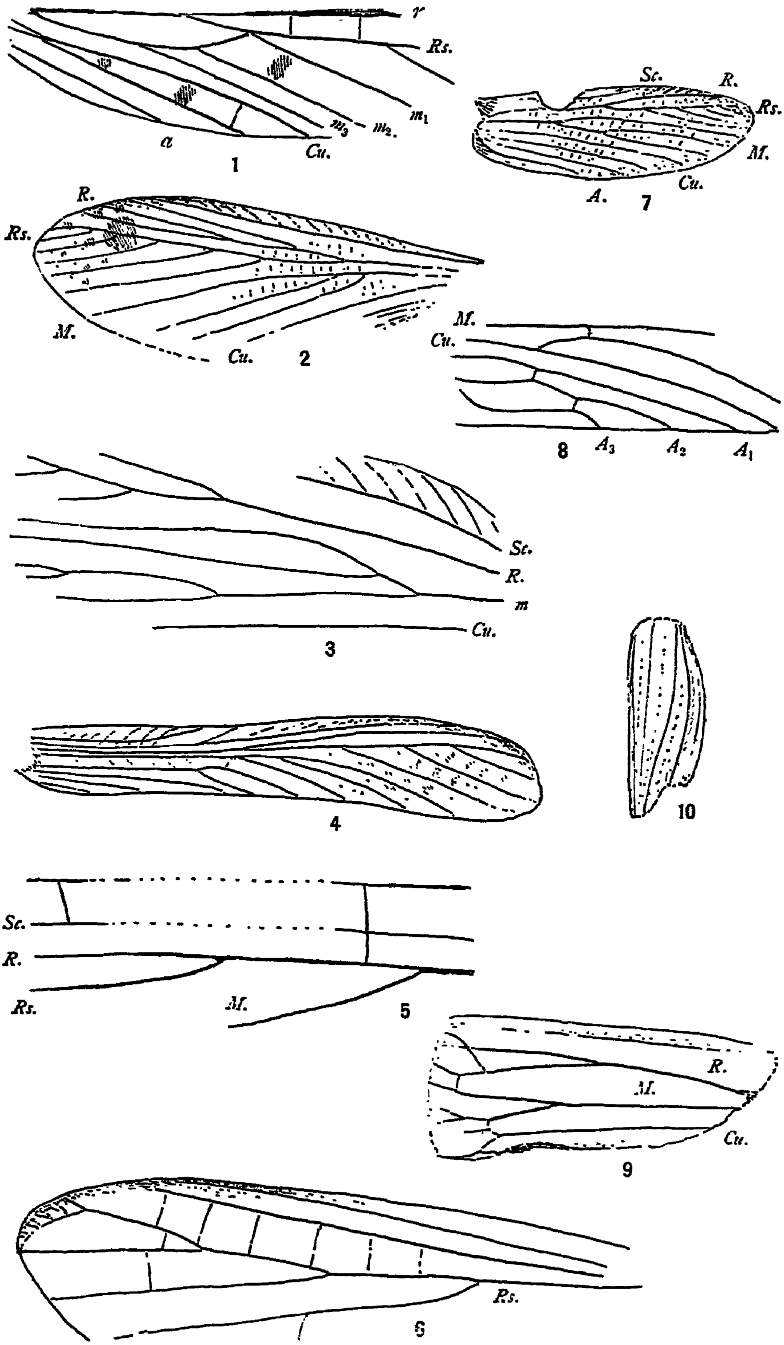
FIG. 1. *Protoberis obliteratus*, new species. *A*, end of third vein; *B*, praefurca and adjacent parts.
2. *Ephydra sepulta*, new species. *A*, discal cell and adjacent parts; *B*, bristles of costa.
3. *Sphaerocera sepultula*, new species.
4. *Stenomyites fuscipennis*, new species.
5. *Necropsylla anglica*, new species.
6. *Psylla exhumata*, new species. *A*, anterior wing; *B*, caudal segment; *C*, front of head, with eyes.
7. *Schizoneurites brevirostris*, new species. *A*, anterior wing; *B*, rostrum.

PLATE 64.

FIG. 1. *Aneurhynchus conservatus*, new species. *a*, wings; *b*, abdomen; *c*, three joints of antenna.
2. *Philoponites clarus*, new species.
3. *Ponera hypolitha*, new species.
4. *Ponera hypolitha*, new species. Hind wing. (No. 7527.)
5. *Oecophylla perdita*, new species. (No. 7526.)
6. *Oecophylla perdita*, new species. Male. (No. 7529.) *A*, head and front of thorax; *B*, part of wing.
7. *Oecophylla atavina*, new species. (No. 7569.)

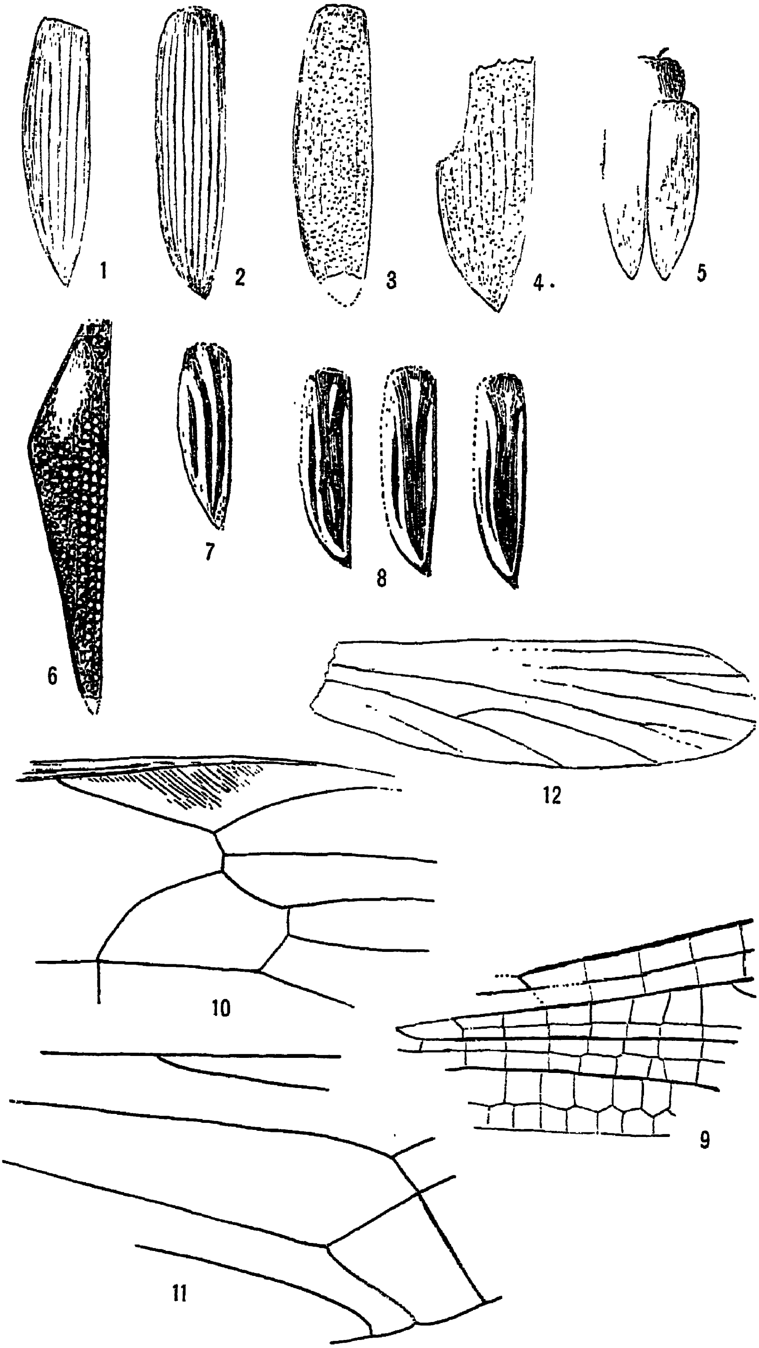
PLATE 65.

FIG. 1. *Oecophylla megarche*, new species. (No. 7525.)
2. *Oecophylla megarche*, new species. Hind wing. (No. 7568.)
3. *Oecophylla megarche*, new species. Mandibles. (No. 7623.)
4. *Leptothorax gurnetensis*, new species. (No. 7526.)
5. *Leptothorax gurnetensis*, new species, var. *a*. (No. 7604.)
6. *Dolichoderus britannicus*, new species. (No. 7578.)
7. *Dolichoderus britannicus*, new species. *A*, longitudinal section of body; *B*, part of wing. (No. 7584.)
8. *Dolichoderus anglicus*, new species. (No. 7610.)
9. *Dolichoderus ovigerus*, new species. (No. 7630.) *A*, part of wing; *B*, egg; *C*, petiole and base of gaster.



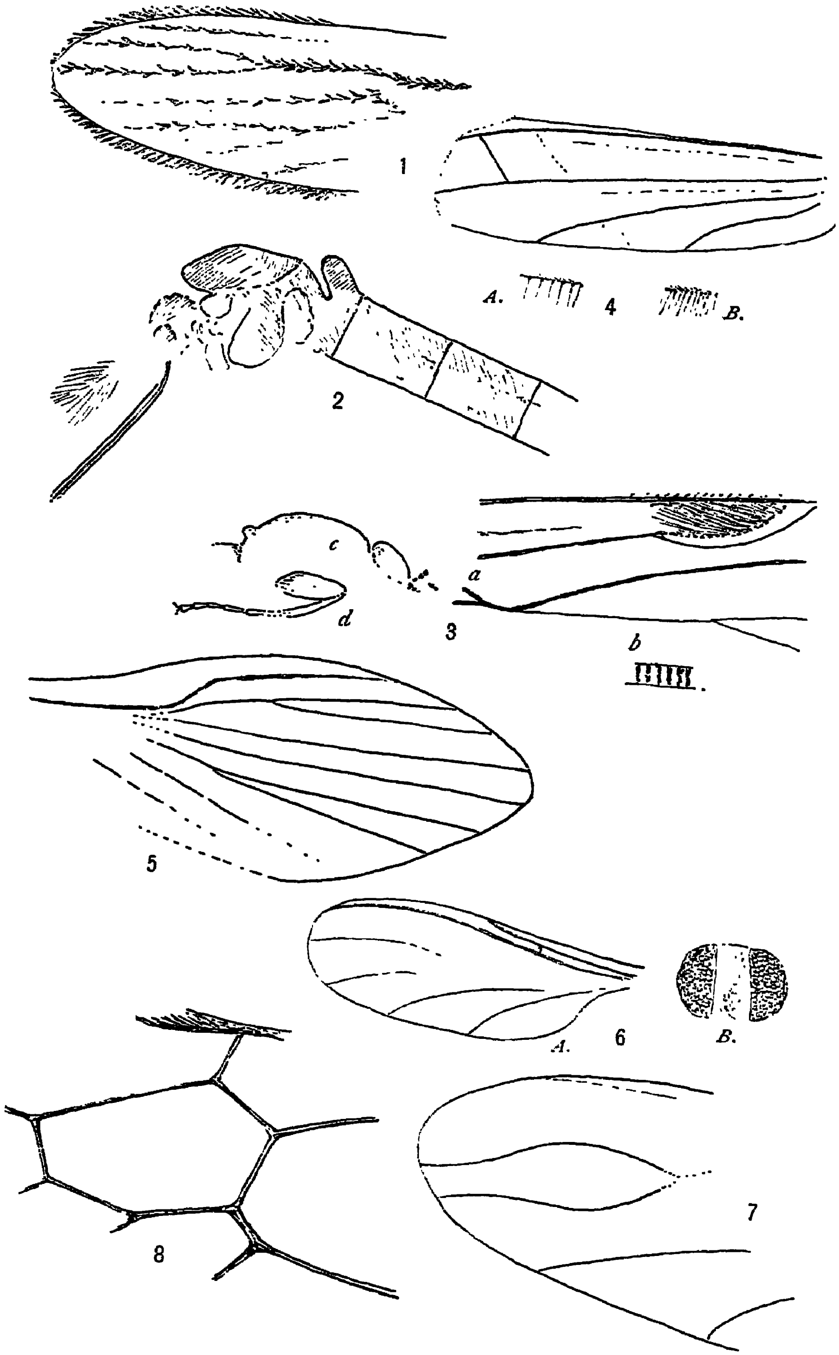
BRITISH FOSSIL INSECTS.

FOR EXPLANATION OF PLATE SEE PAGE 498.



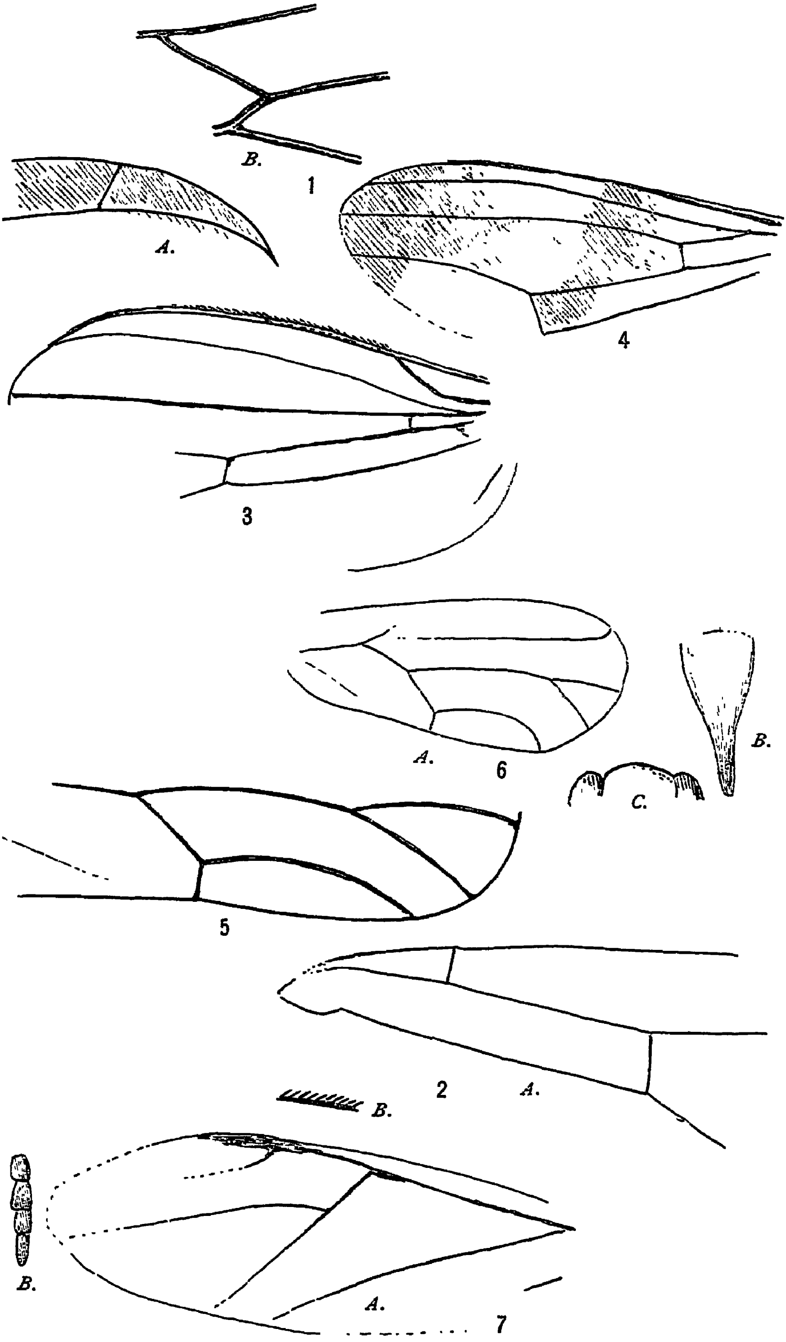
BRITISH FOSSIL INSECTS.

FOR EXPLANATION OF PLATE SEE PAGES 498 AND 499.



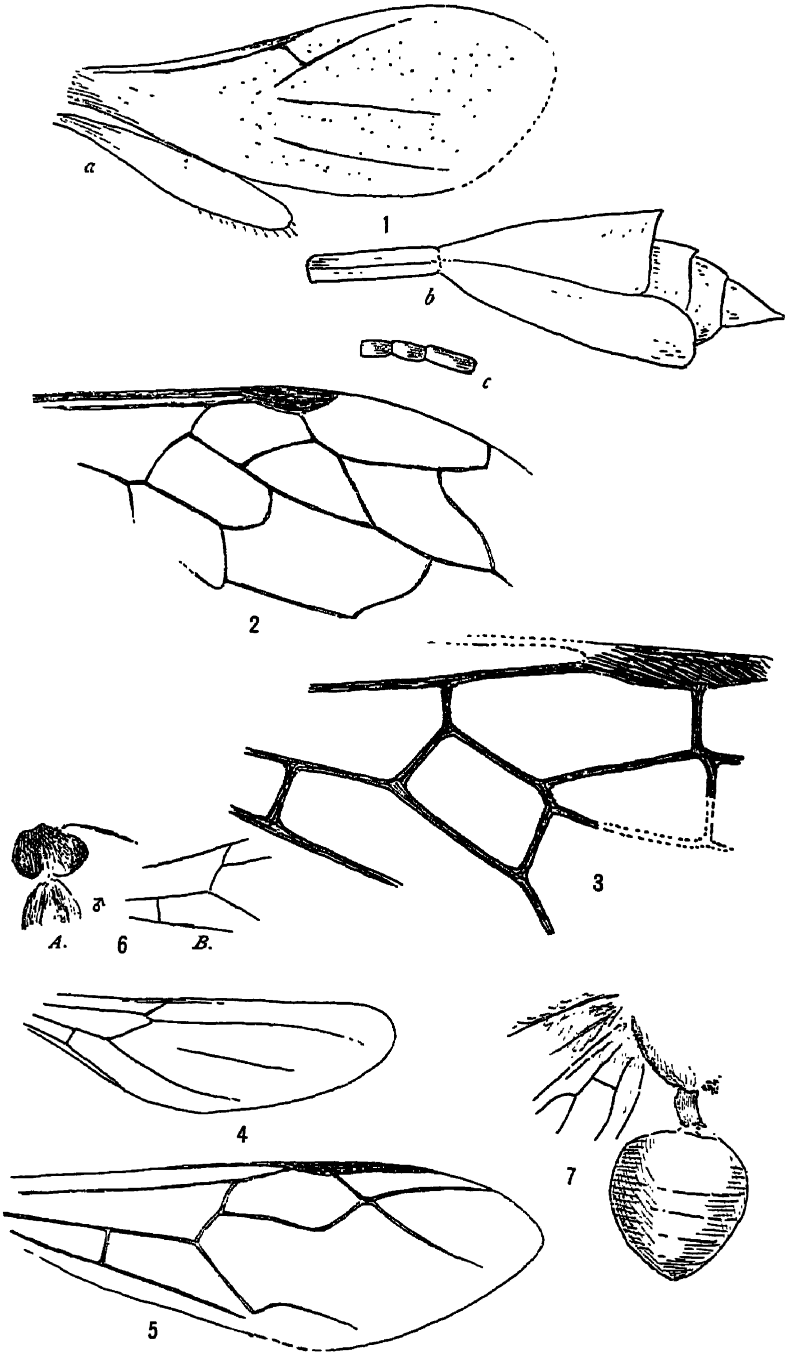
BRITISH FOSSIL INSECTS.

FOR EXPLANATION OF PLATE SEE PAGE 499.



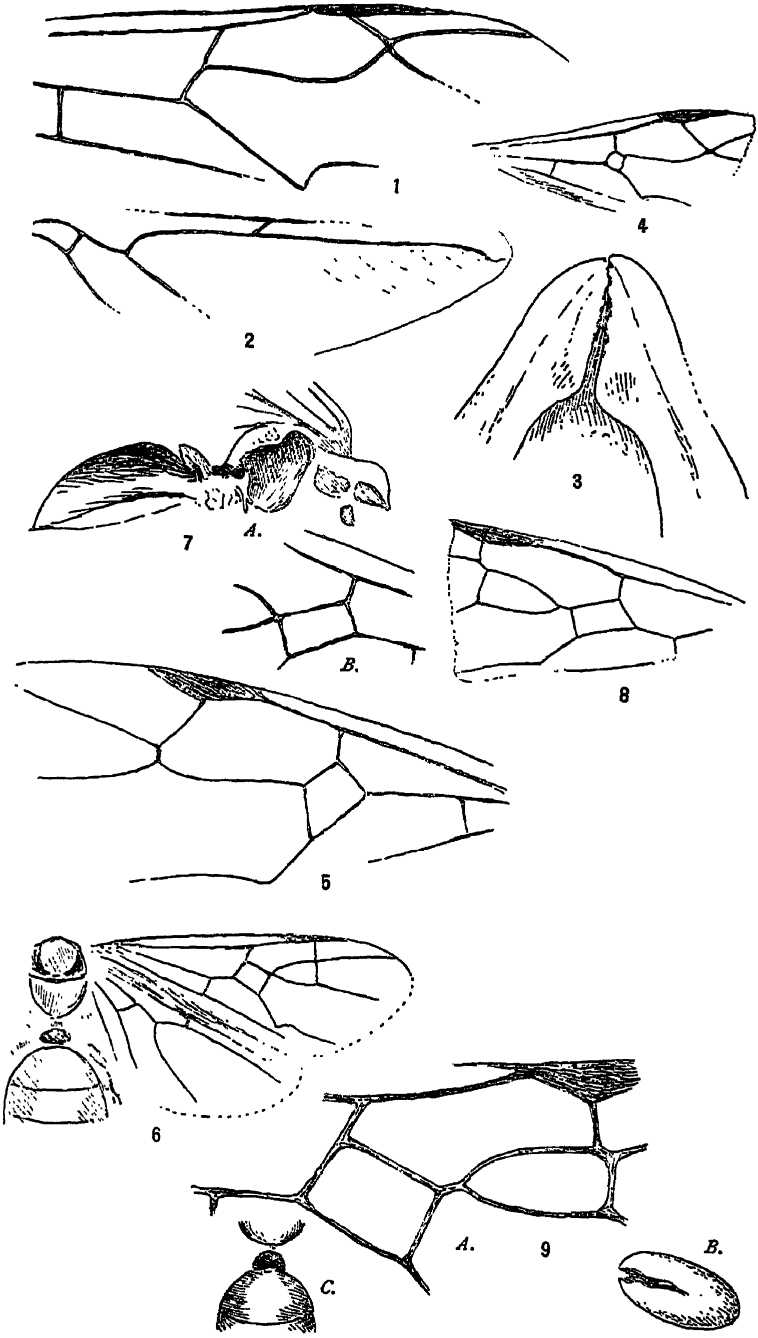
British Fossil Insects.

For explanation of plate see page 499.



BRITISH FOSSIL INSECTS.

FOR EXPLANATION OF PLATE SEE PAGE 499.



BRITISH FOSSIL INSECTS.

FOR EXPLANATION OF PLATE SEE PAGE 499.

ON THE FORE LIMB OF ALLOSAURUS FRAGILIS.

By Charles W. Gilmore,

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In unpacking, recently, that part of the Marsh collection in the United States National Museum from near Canon City, Colorado, a partial skeleton of a carnivorous dinosaur was found. This is of peculiar interest since it has been determined to belong to the same individual as the pelvis and hind limbs described and figured[1] by Prof. O. C. Marsh, years ago, as *Allosaurus fragilis*. Both fore limbs and feet are present, and as they differ materially from the fore limb figured by Marsh in the paper cited above, and especially since an associated fore limb of this genus has not previously been known, it was considered important that a description (of the limb and foot) should be published in advance of the remainder of the skeleton, which is now undergoing preparation, a work that will take some time to complete.

The fore limb figured by Marsh in the Dinosaurs of North America,[2] plate 11, figure 1, as being that of *Allosaurus fragilis* Marsh, is a composite drawing, and, as I will show, is not representative of the genus *Allosaurus*, but is largely that of *Ceratosaurus*.

In going over a lot of tracings and drawings of Theropodous dinosaur bones made for Professor Marsh, a slip of paper in Marsh's handwriting was found, on which he had written instructions to the draftsman for the composition of the *Allosaurus* fore limb (fig. 1), which reads as follows:

Fore limb Allosaurus.

1. Enlarge scapula (1933 as 83.5 is to 100).
2. Make coracoid to correspond (see Phillips, p. 208).
3. Draw humerus (1894 nat. size).
4. Make radius 9½ inches long.
5. Make ulna 9¼ inches long + olecranon.
6. Enlarge foot as 83.5 is to 100.

The number 1933 is the catalogue number of the Peabody Museum originally given to the type-specimen of *Ceratosaurus nasicornis* Marsh before its transfer to the United States National Museum.

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[1] Amer. Journ. Sci., vol. 27, 1884, p. 336, pl. 11.

[2] Sixteenth Ann. Rep. U. S. Geol. Surv., 1896, pt. 1.

The coracoid, which is not present with the *Ceratosaurus* skeleton, was evidently modified from a figure of that bone in Phillips Geology. The humerus is from another specimen and the radius, ulna, and foot were evidently drawn from those bones pertaining to the type-specimen of *Ceratosaurus nasicornis* Marsh.

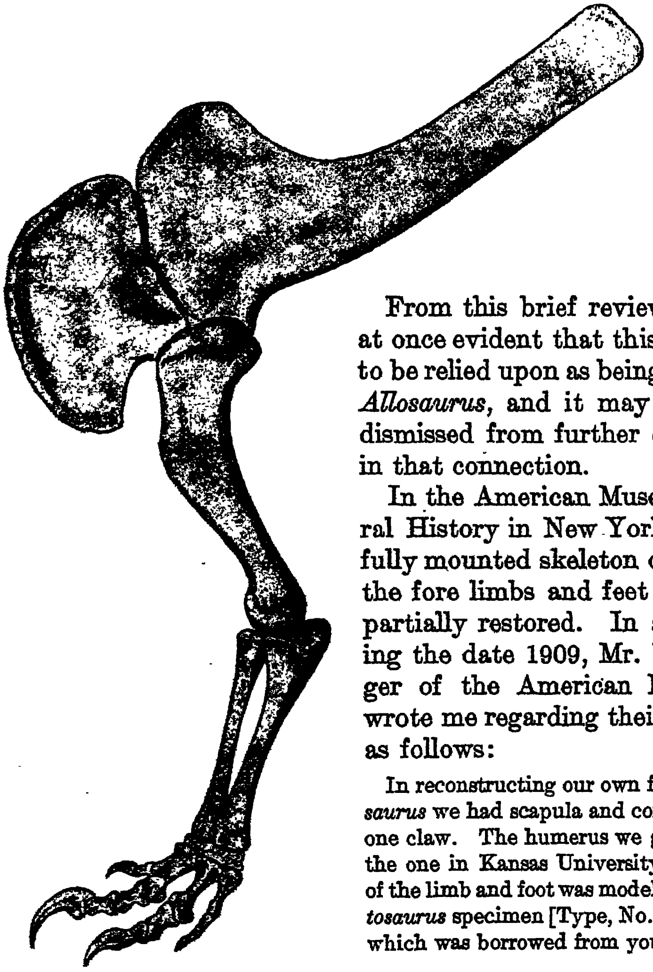

Fig. 1.—Left fore limb of Ceratosaurus (Allosaurus fragilis of Marsh). After Marsh.

From this brief review it becomes at once evident that this figure is not to be relied upon as being of the genus *Allosaurus*, and it may therefore be dismissed from further consideration in that connection.

In the American Museum of Natural History in New York is a beautifully mounted skeleton of *Allosaurus*, the fore limbs and feet of which are partially restored. In a letter bearing the date 1909, Mr. Walter Granger of the American Museum staff wrote me regarding their composition as follows:

> In reconstructing our own fore limb of *Allosaurus* we had scapula and coracoid, ulna, and one claw. The humerus we got from a cast of the one in Kansas University; the remainder of the limb and foot was modeled from the *Ceratosaurus* specimen [Type, No. 4735, U.S.N.M.], which was borrowed from your Museum.

Following the *Ceratosaurus* as a pattern the foot was given four digits, whereas the specimen before me shows quite conclusively that *Allosaurus* had but three digits, with a reduced mtc. III. The phalangial formula in the New York specimen is correct, and the relative proportions of the various segments of the limbs are entirely in accord with the associated material forming the basis of the present paper. In view of the limited fore limb and foot material available at the time of reconstructing this limb and foot of *Allosaurus*, those in charge of that work are to be congratulated upon their close approximation to the facts as revealed by the discovery of this more recent material.

Remove the fourth digit, replace mtc. III by mtc. IV and insert the carpal bones and the limb would be quite in accord with the fossil specimen before me.

Hay[1] in 1908 in commenting upon the New York specimen concluded that it had been wrongly identified as *Allosaurus*, because of the great size of the hand in relation to the other segments of the limb, being led into this mistaken idea by relying upon the then supposed authentic figure of the limb and foot as published by Marsh.

Williston[2] in 1902 in describing some limb material secured by him in Wyoming refers to the so-called *Allosaurus* fore limb figured by Marsh in the following:

> There were two scapulae obtained that certainly show a generic distinction from *Allosaurus*, as I have convinced myself from inspection of the scapula referred by Marsh to that genus, and figured by him in various places. It remains to be seen, however, whether this scapula of Marsh indubitably belongs with the bones first referred by him to *Allosaurus*. I do not think there is conclusive evidence of this.

The facts regarding this scapula as presented on a preceding page bears out Dr. S. W. Williston's conclusion.

The type of *Allosaurus fragilis* Marsh is in the Peabody Museum of Yale University, and in a recent letter Dr. R. S. Lull informs me that it consists of two vertebrae and one phalange, from Garden Park, Canon City, Colorado, collected by B. F. Mudge in 1877. It bears the catalogue number 1930. The type material is from the same locality as the specimen described here and possibly from the same quarry. The fore and hind limbs figured so widely by Marsh do not pertain to the type-specimen, although such reference[3] has been made regarding them.

FORE LIMB AND FOOT.

The fore limb of *Allosaurus* as compared with the hinder is relatively small, but the large size of the processes and the rough nature of their surfaces imply a powerful musculature. The great size of the terminal phalanges and the general structure of the foot indicates that it was used exclusively for seizing, holding, and tearing, and that it had long ago lost its function as an organ of progression. The hand is relatively of enormous size, being slightly longer than the humerus and nearly one and one-half times as long as the forearm. In general it resembles the foot of *Ornitholestes*, although the bones are more robust, and there is no trace with either foot of mtc. IV.

The carpus is ossified, there being two transverse rows, but the precise number of elements composing it yet remains to be determined.

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[1] Proc. U. S. Nat. Mus., vol. 35, 1908, p. 355.

[2] Amer. Jour. Sci., vol. 11, 1901, p. 112.

[3] O. P. Hay, Proc. U. S. Nat. Mus., vol. 35, 1908, p. 355.

There are three digits, which have the phalangial formula of 2, 3, and 4. Digit one is the heaviest of the series and mtc. III is reduced.

Scapula.—Both scapulae are preserved with the present specimen, the right being perfect, as shown in figure 2, with the exception of a small portion of the upper anterior corner of the blade which is missing. The left scapula was injured in life and the subsequent healing produced great deformation of the bone. This pathologic condition caused a widening of the blade that would be entirely misleading as to its true form had not the opposite scapula been present. The scapula of *Allosaurus* is distinctive on account of its bird-like form, as has previously been pointed out by Williston.[1] The shaft is exceptionally long and slender, being nearly of equal width throughout except the uppermost or distal extremity, which is perceptibly widened. This expansion is about equal in fore and aft direction. The upper third is flattened and thin, while more proximally the shaft is trihedral in cross-section, the anterior border being sharp, the posterior one rounded. Longitudinally the external surface is convex, though nearly straight in its middle portion, a shape that probably conformed closely with the convex curve of the body cavity.

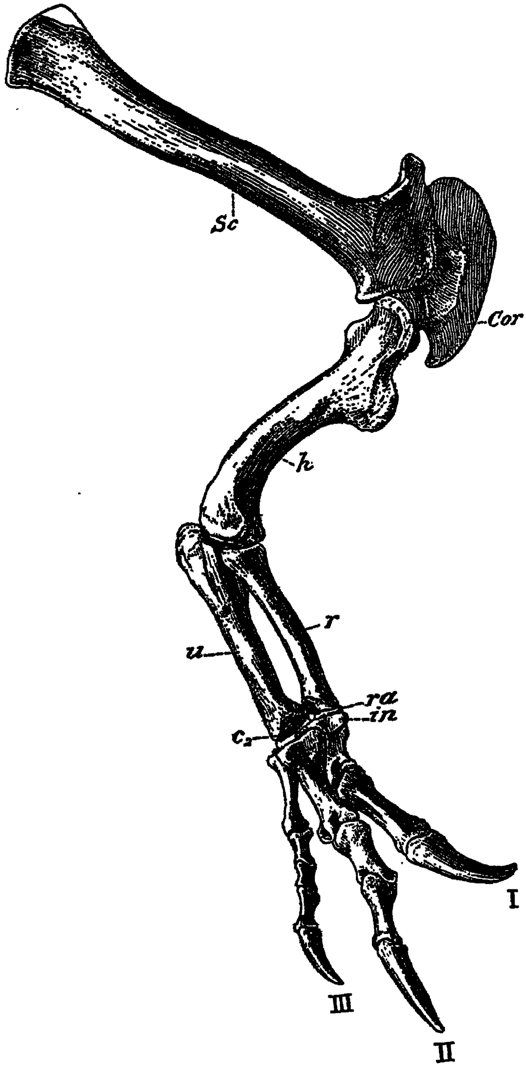

FIG. 2.—RIGHT FORE LIMB AND FOOT OF ALLOSAURUS FRAGILIS MARSH. CAT. NO. 4734, U.S.N.M. ⅛ NAT. SIZE. LATERAL VIEW, C_2, CARPALE TWO; *Cor*, CORACOID; *h*, HUMERUS; *in*, INTERMEDIUM; *r*, RADIUS; *ra*, RADIALE; *Sc*, SCAPULA; *u*, ULNA; I, II, AND III, DIGITS ONE, TWO, AND THREE. THE POSITION OF THE MISSING ULNARE IS INDICATED BY DOTTED LINES.

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[1] Amer. Journ. Sci., vol. 11, 1901, p. 113.

The inner surface of the greater part of the blade is flattened antero-posteriorly while the outer surface, excepting the upper fourth, is rounded in this direction. The articular end being expanded both antero-posteriorly and transversely is heavy, especially on the posterior half, which has a maximum thickness immediately above the glenoid fossa of 58 mm. The scapula unites with the coracoid by a straight suture that bisects the glenoid fossa and is terminated above by a deep notch between the scapula and coracoid on the anterior border. In this individual both scapulae are firmly coossified with their respective coracoids. The scapula of this specimen appears to agree in all particulars with the one found with the mounted skeleton of *Allosaurus* in the American Museum of Natural History, and it also shows that the limb described by Williston should be referred to this genus.[1] In this connection it is of interest to know that the *Ceratosaurus* scapula which formed the basis for the illustration of this bone in the so-called fore limb of *Allosaurus* is now in the United States National Museum collections (fig. 1). I have recently examined the bone and find that its upper extremity is incomplete, so that it is not positively known whether this blade has a nonexpanded end as represented by Marsh or whether it was expanded as in *Allosaurus.* It differs, however, from *Allosaurus* in having a thinner and wider shaft and a more abrupt backward curve of the heavy posterior border just above the glenoid fossa. Both inner and outer surfaces of the lower three-fourths of the shaft in *Allosaurus* are rounded. Both of these specimens came from the famous quarry No. 1 near Canon City, Fremont County, Colorado.

Measurements of scapula.

	mm.
Greatest length of right scapula and coracoid, measured along outside curve...	795
Greatest length of right scapula..........	652
Greatest breadth of right scapula..........	175
Greatest breadth of blade, upper end..........	[2] 145
Least breadth of blade..........	52
Greatest expanse of glenoid fossa..........	71

Coracoid.—The coracoid in *Allosaurus* is quadrangular in outline, the infero-superior measurement exceeding the antero-posterior diameter. The outer surface is convex in all directions, the inner decidedly concave antero-posteriorly. There is a broad notch on the inferior border.

The coracoid is pierced by the usual foramen, which runs diagonally through the bone, the external exit being larger than the internal. This foramen is entirely inclosed (fig. 2), not a notch as shown in Marsh's figure of the coracoid (fig. 1). The superior border presents a thin flattened edge, the anterior edge gradually thickening toward the inferior border.

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[1] Amer. Journ. Sci., vol. 11, 1901, p. 113.

[2] Estimated.

Measurements of coracoid.

	mm
Greatest length at center	120
Greatest depth at center	170

Humerus.—Comparatively the humerus of *Allosaurus* is short and somewhat sigmoid in form. The shaft is hollow, as are all of the limb and foot bones of this genus. Planes passed through the greatest diameters of the articular ends would cut one another at an angle of 50°. This unusual angulation throws the articulated radius and ulna well out away from the body. The deltoid or radial crest is strongly developed as a short but high thin plate of bone, that is situated on the anterior-external border immediately above the middle of the shaft. Viewed from the front it renders the anterior surface deeply concave transversely (fig. 3). Below this crest the shaft is constricted and angularly rounded in cross-section. The head is situated in about the middle of the proximal end with the articular portion overhanging the posterior surface of the shaft. The radial and ulnar condyles are well defined. Posteriorly they are separated by an unusually broad but shallow depression which continues somewhat upward on the shaft of the bone. The articular ends of the humerus are rugosely roughened. A prominent roughened oval-shaped area on the posterior-external surface at the lower border of the radial crest probably represents the point of insertion for the humero-radialis muscle (fig. 2). The measurements given below were made from the humerus of the right side, which is the better preserved of the two:

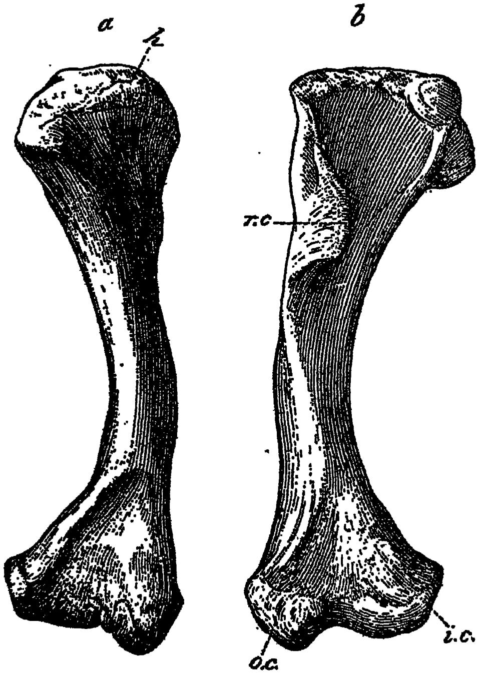

FIG. 3.—RIGHT HUMERUS OF ALLOSAURUS FRAGILIS MARSH. CAT. No. 4734, U.S.N.M. ¼ NAT. SIZE. *a*, BACK VIEW; *b*, FRONT VIEW; *h*, HEAD; *r, c.*, RADIAL CREST; *i. c.*, INNER CONDYLE; *o. c.*, OUTER CONDYLE.

Measurements of humerus.	*mm.*
Greatest length	310
Greatest width of proximal end	118
Greatest width of distal end	100
Least diameter of shaft	38

Ulna.—The ulna is expanded and heavy proximally with a less expanded distal end. It exceeds the radius in length but is shorter than the humerus. The proportion being as 1::1.17.

There is a heavy olecranon process (*o*, fig. 4) that extends considerably above the articular surface for the humerus. The surface of this process is roughened for muscular insertion. The olecranon process is less well developed in *Ceratosaurus nasicornis* and appears to be entirely wanting on the ulna of *Ornitholestes hermani.*

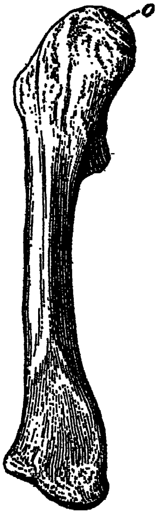

FIG. 4.—LEFT ULNA OF ALLOSAURUS FRAGILIS MARSH. CAT. NO. 4734, U.S.N.M. ¼ NAT. SIZE. POSTERIOR VIEW.

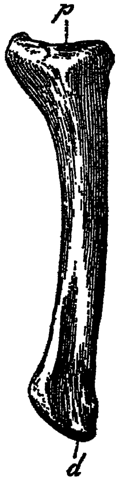

FIG. 5.—RIGHT RADIUS OF ALLOSAURUS FRAGILIS MARSH. CAT. NO. 4734, U.S.N.M. ¼ NAT. SIZE. INTERNAL VIEW. *d*, DISTAL END; *p*, PROXIMAL END.

The articular surface for the humerus is comparatively narrow transversely, with a shallow concave surface antero-posteriorly. The concavity on the proximal end for the reception of the head of the radius is shallow. The shaft of the ulna is slender, suboval in cross-section, and in a distal direction, gradually expanding into a moderately large end, the greatest diameter being antero-posterior. The distal end is oblique to the longer axis of the bone, the surface of which looks downward and forward in the articulated limb. On the inner anterior face of the distal end a prominent roughened protuberance presents a surface for union with the radius.

Measurements of ulna.	*mm.*
Greatest length	263
Greatest diameter of proximal end	90
Greatest diameter of distal end	55
Least diameter of shaft	24

Radius.—The radius is more slender and somewhat shorter than the ulna. The proximal and distal ends are expanded, more especially the former (fig. 5). In cross-section the shaft is angularly rounded throughout the greater part of its length. The proximal end is shallowly concave in its greatest diameter. Viewed from above this end is suboval in outline. The distal end is subtriangular in outline, with an oblique surface that looks downward and outward. It articulates exclusively with the radiale of the carpus. The inner surface where the radius meets the ulna is slightly roughened.

Measurements of radius.	*mm.*
Greatest length	222
Greatest diameter of proximal end	56
Greatest diameter of distal end	40
Least diameter of shaft	20

Carpus.—The ossified carpus in *Allosaurus* consists of at least five elements, with a possibility of there being one more. Three disarticulated elements were found with the bones of the left foot and three with the right, but since there is an element with each foot that is not present in the other, and the ulnare is lacking in both, the presence in the complete carpus of five ossified carpals is quite conclusively demonstrated. Fortunately two of those pertaining to the right foot (fig. 7, *in* and c_2), the intermedium and a carpale, probably c_2, were found in position, firmly attached to metacarpals I and II, and these give the first definite knowledge we have of the exact manner of their articulation. Without such evidence it would be almost impossible to place them properly. I was also able to determine the proper articulation of the radiale by its position as found in the matrix and also by its close articulation with the grooved surface of the intermedium.

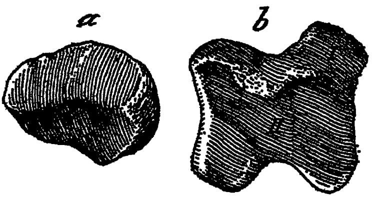

FIG. 6.—CARPAL BONES OF ALLOSAURUS FRAGILIS MARSH. CAT. NO. 4734, U.S.N.M. ½ NAT. SIZE. VIEWED DISTALLY. *a*, RADIALE OF THE RIGHT FORE FOOT; *b*, INTERMEDIUM OF THE LEFT FORE FOOT; *II*, SURFACE ARTICULATING WITH METACARPAL II, *I*, SURFACE ARTICULATING WITH METACARPAL I.

The radiale is a flattened discoidal element, irregularly oval in outline (fig. 6*a*). The upper articular surface is shallowly concave while the distal surface is angularly convex. This surface in the articulated foot articulates for more than half its area with the intermedium and slightly if at all with the inner posterior corner of mtc. I. Its greatest transverse diameter is 41 mm.; greatest thickness, 15 mm.

The intermedium as shown in figure 6*b*, is an irregularly quadrangular bone. Articulated it rests about equally upon the proximal ends of mtcs. I and II (fig. 2, *in* and *ra*). The upper surface presents a broadly grooved surface for the radiale (fig. 7), with a projecting spur on the anterior face that continues to the outer border of mtc. I, so that when viewed from the front it appears to completely cover the metacarpal. On the posterior external side a somewhat similar projection overlaps a beveled surface on the outer proximal end of mtc. II. The outer end of this projection is separated by a notch from a smaller process on the anterior border that also rests upon a beveled articular facet on the end of mtc. II. The intermedium has a greatest transverse diameter of 51 mm.; greatest antero-posterior diameter is 40 mm.

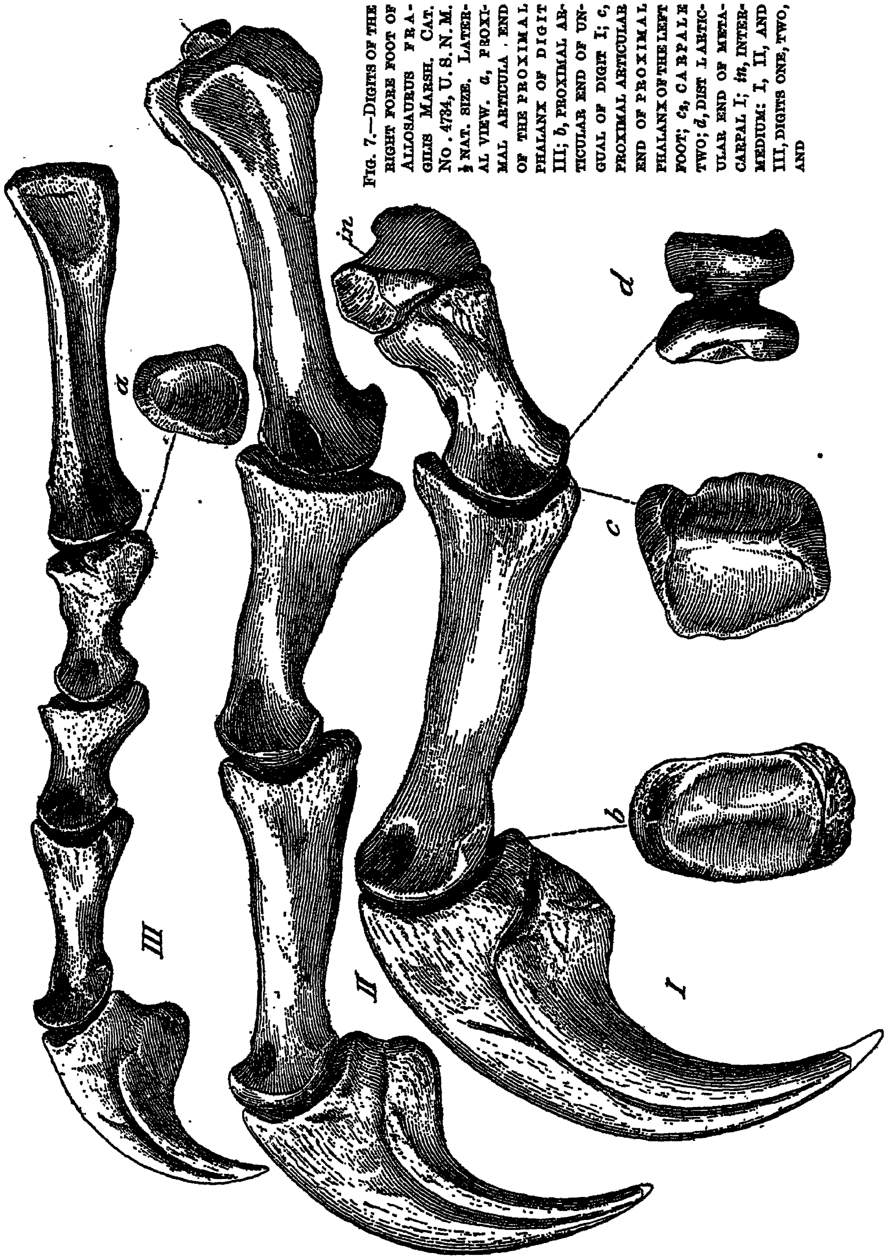

FIG. 7.—DIGITS OF THE RIGHT FORE FOOT OF ALLOSAURUS FRAGILIS MARSH. CAT. NO. 4734, U.S.N.M. ½ NAT. SIZE. LATERAL VIEW. *a*, PROXIMAL ARTICULAR END OF THE PROXIMAL PHALANX OF DIGIT III; *b*, PROXIMAL ARTICULAR END OF UNGUAL OF DIGIT I; *c*, PROXIMAL ARTICULAR END OF PROXIMAL PHALANX OF THE LEFT FOOT; *c2*, CARPALE TWO; *d*, DIST LARTICULAR END OF METACARPAL I; *in*, INTERMEDIUM: I, II, AND III, DIGITS ONE, TWO, AND

The ulnare is not known. Carpale two is apparently represented by the small flattened ossicle that was found attached to the proximal end of mtc. II (fig. 7*c*), of the right foot which is in close apposition to the outer anterior border of the intermedium. A detached bone found near the left manus is regarded doubtfully as representing c_3. It is elongated in one diameter with angularly rounded surfaces. There is no clue as to the position it occupied on the foot, if indeed it represents such an element. Its longest diameter is 31 mm., with a least diameter of 11 mm.

Metacarpus.—The complete metacarpus in *Allosaurus* apparently consists of three elements, there being no trace in either foot, of mtc. IV which is present in the manus[1] of *Ornitholestes hermani* Osborn.

Mtc. I is a short heavy bone with a deeply grooved distal end that is turned inward away from the central axis of the foot. The articular facets extend well upward on both front and back aspects (fig. 7*d*), rising about equally above these surfaces of the shaft. The lateral pits are moderately shallow, the outer one being the better defined. Viewed from above the proximal end is subtriangular in outline with a shallow concave articular end. This surface is opposed in the articulated foot by the radiale and intermedium, the former only touching slightly the hinder internal corner, the remaining surface being closely applied to the intermedium, as shown in the right foot, where these bones were found articulated. Mtc. I articulates closely on its upper half with mtc. II (fig. 2), resting in a broad shallow depression on the side of that bone. Mtc. II is an elongate bone, having an expanded subquadrangular proximal end, rather a slender, angular rounded shaft, and a less expanded but broadly grooved distal extremity. The articular surfaces of the distal end of this bone are continued backward in the form of two lateral condylar-like facets, which are separated by a deep and moderately broad notch. The external one is the larger of the two. The inner border of the proximal end is beveled off, forming two facets of unequal size for the articulation of the intermedium. The remaining proximal surface is smooth though sloping toward the outside of the foot. Mtc. III is reduced, being the weakest element of the metacarpus. Although present with both feet, it was detached in both instances. The character of the surfaces appears to indicate, however, that in position it has a weak articulation with mtc. II on the postero-external angle as shown in figure 2. Unlike the other metacarpals, the distal articular end is not grooved but is smoothly rounded (fig. 7*a*). The posteriorly directed facets are weakly developed, but are separated by a shallow groove as in mtcs. I and II.

Phalanges.—The phalangial formula is 2, 3, 4. All of the digits, as shown in figure 7, are terminated with latterly compressed, sharply pointed claws, the first being especially robust, the third much reduced in size. The proximal phalanx of digit one is the longest of the series. The proximal articular surface is concave supero-inferiorly, with a strongly developed vertical keel which articulates with the deep groove on the distal end of mtc. I. This keel as shown in figure 7*c*, divides this articular end into two unequal concave surfaces, the larger one being toward the outer side of the foot. It is inclined to the vertical axis of the bone and when articulated rotates the distal end so that the ungual phalanx is turned inward from the vertical as shown in figure 2. The articular surface for the claw is broadly grooved, and this surface extends well backward on the under side, thus throwing the articulated ungual downward at nearly a right angle to the longer axis of the first phalanx. The lateral pits are comparatively shallow, the one on the external side being the better defined. Viewed from above the shaft is quite evenly rounded transversely, while the ventral surface presents a flattened aspect. The ungual of digit one is especially robust, with a regularly curved and sharply pointed extremity. Well-defined lateral grooves run back from the tip on both sides, but as they approach the proximal end curve downward, passing into a broad smooth surface on the posterior ventral surface. The proximal articular surface is keeled as shown in figure 7*b*.

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[1] H. F. Osborn, Bull. Amer. Nat. Hist., vol. 19, 1903, pp. 462, 463, figs. 2 and 3.

The proximal phalanx of digit two is shorter than the second of that toe. The proximal end of the former is expanded especially in the vertical direction. The proximal end as compared with the same phalanx of digit one is only slightly concave supero-inferiorly with a comparatively low obtuse keel, placed more toward the inside of this end. Like the keel on the proximal phalanx of digit one it is placed at an angle to the vertical axis of the bone. The concave lateral depressions on either side near the distal extremity are so shallow and illy defined they could hardly be designated as pits. The second phalanx of this digit is slightly longer than the first, with a sharply keeled proximal end and broadly grooved distal articulating surface. The lateral pits are small but well defined. The ungual phalanx is intermediate in size between those of the first and third toes.

The proximal phalanx of digit three can be distinguished from all others in the foot by the keelless, but cupped articular surface of the proximal end (fig. 7*a*). It is relatively short, as is the second, the third being more elongate. The proximal ends of the other phalanges of this toe are keeled, and the distal ends are grooved. The ungual except for its small size is very similar to the ungual of digit two. These two unguals are distinguishable from the ungual of digit one, not only by difference in size but also by the change in direction of the heavy portion below the articulating surface. In the two former in the articulated foot it looks almost directly backward, whereas in the first it is directed downward and backward. A comparison of this foot with the manus recently described by Lambe[1] leads me to believe that the digit designated by him as the second is really the first. This is indicated by the shortness of mct. I, and especially by the phalangial formula. In all associated fore feet of Theropodous dinosaurs as shown in the accompanying table, there are two phalanges on the first digit with a progressive increase to the point where some of the lateral toes have commenced to degenerate. The lengthening of the penultimate phalanges appears peculiar to Theropodous dinosaurs and is a mechanical development for the more perfect use of the talons of the fore feet. The principal measurements of the bones of the manus are shown in the following table:

MEASUREMENTS OF FORE-FOOT ELEMENTS.

Metacarpals.

	I.		II.		III.	
	R.	L.	R.	L.	R.	L.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Greatest length	73	....	125	122	105	97
Greatest transverse diameter, proximal end	35	....	56	63	29	28
Greatest transverse diameter, distal end	36	....	46	46	23	22
Least transverse diameter, shaft	35	....	22	22	11	10

Phalanges.

	I. R.	I. L.	II. R.	II. L.	III. R.	III. L.
Greatest length first row phalanges	136	138	94	94	50	42
Greatest length second row phalanges	118	120	102	....	41	43
Greatest length third row phalanges	....	....	95	....	52	55
Greatest length fourth row phalanges	....	....	....	....	61	59

PHALANGIAL FORMULAE OF VARIOUS THEROPODS.

Names.	Digits.					Formation.	Remarks.
	I.	II.	III.	IV.	V.		
Gorgosaurus libratus Lambe	0	2	3	0	0	Belly River, Upper Cretaceous.	Skeleton in Ottawa Museum, Canada.
Ceratosaurus nasicornis Marsh	2	3	3	1	0	Morrison, Upper Jurassic.	Mounted skeleton in U.S.N.M., Cat. No. 4735. Marsh's fig. D. of N. A. (*Allosaurus fragilis*).
Ornitholestes hermani Osborn	2	3	4	0	0	.....do	Mounted skeleton in A. M. N. H., No. 587.
Allosaurus fragilis Marsh	2	3	4	1	0	Morrison	Mounted skeleton in A. M. N. H.
Do	2	3	4	0	0	Morrison, Upper Jurassic.	Skeleton in U.S.N.M., No. 4734.
Hallopus victor Marsh	2	3	4	3	0	Upper Jurassic	Evidence for formula unknown. Specimen in Yale University.
Compsognathus longipes Wagner	2	3	3	0	0	.....do	From Marsh's restoration of the skeleton.
Anchisaurus polyzelus Marsh	2	3	4	2	1	Triassic	Formula that of restoration by Marsh. in D. N. Am. Skeleton in Yale Museum.
Anchisaurus colurus Marsh	2	3	4	3	1	.....do	Skeleton in Yale Museum.

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[1] The Ottawa Naturalist, vol. 27, 1914, pp. 219–131, pl. 13.

The more important progressive changes that have taken place in the specialization of the fore limb and foot in the carnivorous dinosauria during successive geological periods now appear to be, (1) a reduction in the number of digits; (2) the elongation of the penultimate phalanges; (3) a lengthening of the scapula; (4) the shortening of the fore arm; (5) a relative reduction in size of the entire fore limb.

With the exception of *Ceratosaurus*, which has both inner and outer fingers reduced, all of the other known carnivores show that the reduction in the number of digits takes place on the outside of the foot. Beginning with the oldest known Theropods from the Triassic, all are found to possess the full complement of five digits, though the fifth is often rudimentary. In the Jurassic we find in *Ornitholestes* that the fifth digit has entirely disappeared, and the fourth is only represented by a vestigal metacarpal. *Allosaurus* appears to have gone still further and apparently the fourth has been lost and the third is somewhat reduced, and approximately the same condition obtains in the hand of *Comsognathus* from the Upper Jurassic of Bavaria.

Our knowledge of the manus in the Cretaceous Theropodous dinosaurs is rather meager at this time, but a specimen recently described by Lambe[1] (*Gorgosaurus libratus*) from the Upper Cretaceous (Belly River) shows a still further reduction, there being only two functional digits, the third (fourth of Lambe) being represented by the vestigal metacarpal only.

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[1] Ottawa Naturalist, vol. 28, 1914, pp. 13–17.

A SYNOPSIS OF THE RACES OF THE CRESTED TERN, THALASSEUS BERGII (LICHTENSTEIN).

By Harry C. Oberholser,

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The identification of United States National Museum material collected in the East India Islands by Dr. W. L. Abbott has involved a canvass of all the races of *Thalasseus bergii.* Some of these have a more or less uncertain status, owing to the divergent views of recent authors;[1] and the following conclusions, based upon a careful study of the questions involved, throws, I hope, a little further light on the relationships and geographical distribution of the various subspecies. Although the specimens examined have not been numerous, only about 45, they are of importance since none of them was available to either Mr. Mathews or Mr. Stresemann, the two authors who have most recently monographed the species. These specimens comprise the collections of the United States National Museum and the Museum of Comparative Zoölogy at Cambridge, Massachusetts, and include birds from most ports of the range of the species, together with the types of *Sterna rectirostris* Peale and *Sterna bergii boreotis* Bangs. While I have been unable to see examples of *Thalasseus bergii thalassinus, Thalasseus bergii velox, Thalasseus bergii bakeri* or *Thalasseus bergii gwendolenae*, the measurements of these races given by Mr. Stresemann,[2] together with notes which Mr. Mathews, who has had access to Mr. Stresemann's material, has very kindly furnished, have very well supplied the deficiency.

Measurements in this paper are all in millimeters, and those in the tables have been taken as in the author's recent paper on *Butorides virescens.*[3] For the sake of comparison I have added the wing measurements of each race as given by Mr. Stresemann;[4] since, owing to the fact that these are invariably greater than my own, there seems to be indication of a difference in our methods of measuring.

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[1] Bangs, Bull. Mus. Comp. Zoöl., vol. 36, 1901, p. 257; Mathews, Birds of Australia, vol. 2, pt. 3, Sept. 20, 1912, pp. 346–347; Stresemann, Novit. Zool., vol. 21, Feb. 25, 1914, pp. 57–59.

[2] Novit. Zool., vol. 21, Feb. 25, 1914, pp. 57–59.

[3] Oberholser, Proc. U. S. Nat. Mus., vol. 42, Aug. 29, 1912, p. 533.

[4] Novit. Zool., vol. 21, Feb. 25, 1914, pp. 57–59.

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The names of colors used are from Mr. Ridgway's recent "Color Standards and Color Nomenclature."

The geographical distribution of *Thalasseus bergii* is extensive, and almost wholly littoral, reaching north to the Marshall Islands, the Riu Kiu Islands of Japan, southern China, northern India, the Persian Gulf, and the Red Sea; west to the Red Sea and German Southwest Africa; south to the Cape of Good Hope, Madagascar, Rodriguez Island, Ceylon, Sumatra, Java, southwestern Australia, Tasmania, the Tonga Islands, and the Society Islands; east to the Paumotu Islands, and the Marquesas Islands. It is also of casual occurrence in Palestine. Over its regular range it seems to be resident throughout the year.

This species is really a difficult one, and presents much variation of both size and color to trouble the systematist; but, notwithstanding this, it is possible to recognize at least 11 subspecies, though most of them, it is true, rest on average characters. Much to reduce this number, however, as Mr. Stresemann has done, merely serves to increase rather than to decrease the difficulty; for the latitude of individual variation which such an arrangement allows many of the forms is so great as widely to overlap and seriously impair the assignable characters of some of the other forms which are current and certainly worthy of recognition by name. Although there is considerable individual variation in both size and color in most of the subspecies admitted in the following pages, this variation does not obliterate the usually well-marked average characters of a given race. Notwithstanding this individual variation there seems to be little or no sexual difference, which happpily renders unnecessary separate comparisons of male and female.

The juvenal plumage varies considerably from that of the adult, as follows: Whole pileum streaked with brown; occipital crest dull dark brown; upper parts, including superior wing-coverts, dull brown mottled with white; tail mostly dark brown, the feathers tipped with white; and dark portions of wing-quills dull dark brown.

The present species, together with several others closely allied, are without much doubt generically distinct from the members of the true genus *Sterna*, the type of which is *Sterna hirundo* Linnaeus. The structural differences separating *Sterna bergii* from *Sterna hirundo* consist chiefly in relatively shorter tail, this not over half the length of wing; relatively longer bill, this at least two-elevenths of the length of the wing; stouter bill; less prominent angle of gonys, the height of bill through this angle being decidedly less than at the anterior end of nostril, while in *Sterna* it is practically the same; and the presence of an occipital crest of pointed feathers.

The generic name to be applied to the group including *Sterna bergii* has been somewhat in dispute, for it involves the question of the right of an author to designate as the type of a polytypic genus, the type of which has remained unfixed, a species which has already become the monotypic type of a genus subsequently instituted. There seems, however, to be little doubt of the wisdom and reasonableness of the affirmative decision in such cases. The nomenclatural situation of the generic group now under our consideration is as follows: Boie was the first author to divide the Linnaean genus *Sterna*, and he, in 1822,[1] proposed the generic name *Thalasseus* for *Sterna caspia* Pallas (=*Hydroprogne caspia* [Pallas]), *Sterna cantiaca* Gmelin (=*Sterna sandvicensis* Latham), and *Sterna anglica* Montagu (=*Gelochelidon nilotica* [Gmelin]). The type of *Thalasseus* was first designated by Wagler in 1832[2] as *Sterna cantiaca* Gmelin, which species had, however, meanwhile (in 1829) been made the type by monotypy of the genus *Actochelidon* Kaup.[3] The latter generic term must therefore fall as a synonym of *Thalasseus* Boie; as must of course also the later *Pelecanopus* Wagler,[4] the type of which by monotypy is *Sterna pelecanoides* King (= *Thalasseus bergii pelecanoides* [King]). As there seem to be no other applicable names, the proper generic designation of the group comprising *Sterna bergii* is therefore *Thalasseus* Boie. The following species, together with their subspecies, belong to this genus:

Thalasseus bernsteini (Schlegel).
Thalasseus bergii (Lichtenstein).
Thalasseus bengalensis (Lesson) (=*Sterna media* Horsfield not Vieillot).
Thalasseus elegans (Gambel).
Thalasseus eurygnathus (Saunders).
Thalasseus maximus (Boddaert).
Thalasseus sandvicensis (Latham).

The chief differential characters of the recognizable races of *Thalasseus bergii* appear in the following key:

KEY TO THE SUBSPECIES OF THALASSEUS BERGII.

- a^1. Size larger (wing averaging more than 350 mm.).
  - b^1. Upper parts of a much paler gray.
    - c^1. Lighter above.............................. *Thalasseus bergii bergii* (p. 518).
    - c^2. Darker above........................ *Thalasseus bergii gwendolenae* (p. 526).
  - b^2. Upper parts of a much darker gray.
    - c^1. Larger (wing averaging about 380 mm.)...... *Thalasseus bergii bakeri* (p. 519).
    - c^2. Smaller (wing averaging less than 370 mm.).
      - d^1. Lighter and larger (wing averaging about 368 mm.). *Thalasseus bergii velox* (p. 519).
      - d^2. Darker and smaller (wing averaging about 357 mm.). *Thalasseus bergii edwardsi* (p. 520).

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[1] Isis, 1822, p. 563.

[2] Idem, 1832, p. 1225.

[3] Skiz. Entwickl.-Gesch. Natürl. Syst. Eur. Thierwelt, 1829, p. 31.

[4] Isis, 1832, p. 277.

a^2. Size smaller (wing averaging less than 350 mm.).

b^1. Upper parts very dark gray.................. *Thalasseus bergii cristatus* (p. 520).

b^2. Upper parts medium or light gray.

c^1. Mantle darker.

d^1. Smaller (wing averaging less than 325 mm.). *Thalasseus bergii halodramus* (p. 522).

d^2. Larger (wing averaging more than 325 mm.).

e^1. Darker above, and smaller.......... *Thalasseus bergii poliocercus* (p. 525).

e^2. Paler above, and larger............ *Thalasseus bergii pelecanoides* (p. 523).

c^1. Mantle paler.

d^1. Larger and darker .... *Thalasseus bergii rectirostris* (p. 524).

d^2. Smaller and lighter................. *Thalasseus bergii thalassinus* (p. 519).

THALASSEUS BERGII BERGII (Lichtenstein).

Sterna bergii LICHTENSTEIN, Verz. Doubl. Zool. Mus. Berlin, 1823, p. 80 (Cape of Good Hope, southern Africa).

Sterna longirostris LESSON, Traité d'Orn., 1831, p. 621 (no locality; type-locality designated as Cape of Good Hope by Stresemann, Novit. Zool., vol. 21, February 25, 1914, p. 57).

Subspecific characters.—Of large size and pale coloration.

Measurements.—Wing, 340–372 (average, 351.4) mm.; tail, 175–193 (182.4); exposed culmen, 58–68 (62.2); tarsus, 29–33 (31.6).[1] Wing, 360–370 (364.3).[2]

Geographical distribution.—Coasts of southern Africa, north on the western side to Walfisch Bay, German Southwest Africa, and on the eastern coast to Zanzibar, off German East Africa; and Madagascar.

As with all the races of this species, there is considerable individual variation in the gray of the upper surface, but while some darker birds occur, the average is considerably lighter than in any of the other large subspecies. This form is also larger than any other excepting *Thalasseus bergii velox* and *Thalasseus bergii bakeri*.

Detailed measurements of the specimens of the present race examined are as follows:

Measurements of specimens of Thalasseus bergii bergii.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
U.S.N.M.111440[3]	....	Inhambane, Portuguese East Africa.	....	....	345	178	58	32
U.S.N.M.111441[3]	....	do	....	....	350	193	68	31
U.S.N.M.103419[3]	....	South Africa	....	E. L. Layard	372	182	61	33
M.C.Z.11663[3]	....	do	....	do	340	175	66	33
M.C.Z. 11662[3]	....	do	....	do	350	184	58	29

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[1] Five specimens, from southern Africa.

[2] Four specimens, measured by Stresemann.

[3] Used in measurement averages on p. 518.

THALASSEUS BERGII THALASSINUS (Stresemann).

Sterna bergii thalassina STRESEMANN, Novit. Zool., vol. 21, February 25, 1914, p. 57 (Goilon, Rodriguez Island).

Subspecific characters.—Similar to *Thalasseus bergii bergii,* but decidedly smaller and somewhat lighter in color.

Measurements.[1]—Wing, 330–336 (average, 333) mm.

Geographical distribution.—The Seychelles Islands, south to the islands of Aldabra and Rodriguez.

Although the original series was small and we have nothing to add, this race is apparently recognizable. It is, however, in color very close to *Thalasseus bergii rectirostris,* and in size practically identical with *Thalasseus bergii cristatus;* so that if we unite these two[2] as Stresemann proposes, it would be difficult and somewhat inadvisable to keep *Thalasseus bergii thalassinus* separate.

THALASSEUS BERGII VELOX (Cretzschmar).

Sterna velox CRETZSCHMAR, Rüppell's Atlas Reis. Nördl. Afrika, 1826, p. 21, pl. 13 (coasts of the Red Sea).

Subspecific characters.—Similar to *Thalasseus bergii bergii,* but upper parts decidedly darker.

Measurements.[3]—Wing, 356–380 (average, 368) mm.

Geographical distribution.—Coasts of the Red Sea and Gulf of Aden east to Sokotra Island; casually north in winter to the Sea of Galilee, Palestine.

This is one of the darkest races and needs comparison with only *Thalasseus bergii bakeri, Thalasseus bergii edwardsi,* and *Thalasseus bergii cristatus.*

THALASSEUS BERGII BAKERI Mathews.

Thalasseus bergii bakeri MATHEWS, Birds of Australia, vol. 2, pt. 3, September 20, 1912, p. 346 (Mekran coast of southeastern Persia and southwestern Baluchistan).

Subspecific characters.—Similar to *Thalasseus bergii velox,* but larger, and with darker upper parts.

Measurements.[4]—Wing, 374–386 (average, 380.3) mm.

Geographical distribution.—The Konkan coast of northwestern India, northwest to the coasts of the Persian Gulf.

This race appears to be easily recognizable by size alone, for it is by considerable the largest form of the species. Although we have examined no specimens, there is no trouble at all in distinguishing it from all the other dark subspecies, merely from the measurements given by Mr. Stresemann.[5]

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[1] Three specimens, measured by Stresemann.

[2] Novit. Zool., vol. 21, Feb. 25, 1914, pp. 58–59.

[3] Five specimens, measured by Stresemann.

[4] Six specimens, measured by Stresemann.

[5] Novit. Zool., vol. 21, Feb. 25, 1914, pp. 57–58.

THALASSEUS BERGII EDWARDSI Mathews.

Thalasseus bergii edwardsi Mathews, Birds of Australia, vol. 2, pt. 3, September 20, 1912, p. 347 (Ceylon).

Subspecific characters.—Resembling *Thalasseus bergii bakeri*, but decidedly smaller.

Measurements.—Wing, 347–351 (average, 349) mm.; tail, 162–181 (171.5); exposed culmen, 61.5–65 (63.3); tarsus, 31.5–32.5 (32).[1] Wing, 345–384 (average, 359.6) mm.[2]

Geographical distribution.—The coasts of southern India and of the Bay of Bengal; west to the Laccadive Islands; south to Ceylon and Tenasserim; east to Tenasserim and Burma; and north to the mouth of the Ganges River and the Laccadive Islands.

This race is, in size at least, much nearer *Thalasseus bergii velox* than to *Thalasseus bergii bakeri*, which is geographically adjacent; but it is even smaller than the former, as well as apparently somewhat darker above. The two specimens examined measure as follows:

Measurements of specimens of Thalasseus bergii edwardsi.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
U.S.N.M. 172885[3]	Male	Bok Pyin, Tenasserim.	Feb. 9, 1900	Dr. W. L. Abbott.	347	162	65.	32.5
U.S.N.M. 172886[3]	Female	do	do	do	351	181	61.5	31.5

THALASSEUS BERGII CRISTATUS (Stephens).

Sterna cristata Stephens, Shaw's Gen. Zool., vol. 13, pt. 1, 1826, p. 146 ("China and many of the southeastern islands of Asia." Definitely fixed as China by Mathews, Birds of Australia, vol. 2, pt. 3, September 20, 1912, p. 347).

Sterna bergii boreotis Bangs, Bull. Mus. Comp. Zool., vol. 36, 1901, p. 256 (Ishigaki Island, Riu Kiu Islands, Japan).

Subspecific characters.—Like *Thalasseus bergii edwardsi*, but much smaller.

Measurements.—Wing, 308–344 (average, 325.7) mm.; tail, 135–178 (160.3); exposed culmen, 55–62 (57.3); tarsus, 27–28 (27.6).[4] Wing, 324–344 (average, 333.5) mm.[5]

Geographical distribution.—Coast and islands of southeastern Asia north to Fu Chau, China, and the Riu Kiu Islands, Japan; southeast to the northern and western islands of the Philippine Archipelago; and south probably to Cochin China.

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[1] Two specimens, from Tenasserim.

[2] Seven specimens, measured by Stresemann.

[3] Used in measurement averages on p. 520.

[4] Four specimens, from China, Japan, and the Philippine Islands.

[5] Eleven specimens, measured by Stresemann.

The species has been recorded from the following islands of the Philippine Archipelago, on which it is probably represented by *Thalasseus bergii cristatus*, those islands followed by a query being doubtfully placed under this subspecies: Agutaya, Calamianes, Cuyo, Luzon, Masbate, Palawan, Balabec (?), Panay, Guimaras (?), Romblon, Sibuyan, and Tablas.

The birds from Palawan Island are intermediate between *Thalasseus bergii cristatus* and *Thalasseus bergii pelecanoides*, but are decidedly nearer the former. Mr. Mathews[1] has referred all the Philippine birds to the present race, but while specimens from the northern and southwestern islands are undoubtedly this, those from Mindanao Island and the Sulu group, in the southernmost part of the archipelago, are very much paler and belong to the following apparently undescribed subspecies.

The proper name for the present race is, as Mr. Mathews has indicated,[1] undoubtedly *Sterna cristata* Stephens,[2] based on birds from "China and many of the southeastern islands of Asia." Stephens, in addition to his description, quotes Latham,[3] whose account refers chiefly and properly to the bird from China. The Chinese bird is, furthermore, identical with that of the Riu Kiu Islands recently named *Sterna bergii boreotis* by Mr. Bangs,[4] of which we have examined the type. The specimens we have seen measure as follows:

Measurements of specimens of Thalasseus bergii cristatus.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
M. C. Z. 37301[5].....	Male....	Ishigaki Island, Riu Kiu Islands, Japan.[6]	June 15, 1899	I. Zensaku....	344	178	62	28
U.S.N.M. 211263[5] .	Female .	Batangas Bay, Luzon Island, Philippine Islands.	June 7, 1908	P. Bartsch....	.....	155	56	27.5
U.S.N.M. 201655[5] .	Female .	Islet in Malampaya Sound, Palawan Island, Philippine Islands.	Sept. 12, 1906	E. A. Mearns.	308	135	55	27
U.S.N.M. 103421[5] .	....	Amoy, China.......	July 4, 1866	R. Swinhoe...	325	173	56	28
U.S.N.M. 201654 ..	Female juvenal.	Cuyo Island, Philippine Islands.	Sept. 10, 1906	E. A. Mearns .	.....	.....	.....	.....

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[1] Birds of Australia, vol. 2, pt. 3, Sept. 20, 1912, p. 347.

[2] Shaw's Gen. Zool., vol. 13, pt. 1, 1826, p. 146.

[3] Gen. Syn. Birds, vol. 3, pt. 2, 1785, p. 351; Index Orn., vol. 2, 1790, p. 804; Gen. Hist. Birds, vol. 10, 1824, p. 101.

[4] Bull. Mus. Comp. Zool., vol. 36, 1901, p. 256.

[5] Used in measurement averages on p. 520.

[6] Type of *Sterna bergii boreotis* Bangs.

THALASSEUS BERGII HALODRAMUS, new subspecies.

Subspecific characters.—Similar to *Thalasseus bergii cristatus*, but upper parts much paler.

Description.—Type, adult male, No. 191382, U.S.N.M.; Pata Island, near Sulu Island, southern Philippine Islands, November 25, 1903; Dr. E. A. Mearns. Forehead white; crown dull white, heavily spotted with fuscous black; an occipital crest of pointed feathers black, many of them slightly tipped with whitish; broad cervical collar white; rest of upper surface gray, between light mouse gray and light neutral gray; tail of the same color, but the feathers white on both webs basally, this on all but the middle pair occupying about two-thirds of their length; terminal portion of outermost rectrices all but the very tip, and most extensively on outer web, dark quaker drab, rather glaucous; wings of same gray as back, the outer webs of secondaries darker, somewhat brownish, the primaries also darker, the outer quills fuscous black; inner webs of greater coverts and of most of secondaries, a narrow margin on inner webs of inner primaries, a broad margin on inner webs of few outer primaries, and bases of all, white; this white pattern extends on outermost primary over the inner half to two-thirds or more of inner vane, and reaches nearly to the tip, leaving a broad band of fuscous black, about 4 to 6 mm. wide next the shaft; on the second and third quills it is somewhat narrower, and ends in a wedge some 55 or 60 mm. from the tip of the feather; sides of head and neck, together with entire lower parts, including the linings of wings, white, but an ante-orbital spot, an orbital ring, and the post-ocular area black, flecked with white.

Measurements.—Wing, 303–327 (average, 315.9 [1]) mm.; tail, 137.5–168 (153.6); exposed culmen, 54–60.5 (57); tarsus, 25–28 (26.7)[2]. Wing, 335.[3]

Geographical distribution.—The southern and southeastern parts of the Philippine Islands. Recorded from the following islands. Mindanao, Pata, Sulu, Tawi Tawi, islets off Sibutu, Siquijor,[4] Negros,[4] Cebu,[4] Bohol,[4] Leyte,[4] and Samar.[4]

It is with considerable hesitation that I venture to name another subspecies in this much-divided species, but there seems to be no other satisfactory disposition to be made of the birds from the southern Philippine Islands. They are clearly not referable to *Thalasseus bergii cristatus;* and to place them under *Thalasseus bergii pelecanoides* is, on account of their very inferior size, almost as much out of the way. These Philippine birds really combine the small size of

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[1] Some of these specimens are in somewhat worn plumage; consequently the real average wing measurement should be slightly greater than here given.

[2] Nine specimens, from the Philippine Islands.

[3] One specimen, measured by Stresemann.

[4] No specimens examined from this island, but *Thalasseus bergii halodramus* is the probable form occurring here.

Thalasseus bergii cristatus with the pale coloration of *Thalasseus bergii pelecanoides*. The present race seems to be confined to the southern Philippine Islands.

Measurements of specimens of Thalasseus bergii halodramus.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
M.C.Z. 41224[1].....	Male....	Ayala, Mindanao Island, Philippine Islands.	Dec. 10, 1887	E. L. Moseley.	320	167	54	26.5
U.S.N.M. 191905[1]..	...do.....	Zamboanga, Mindanao Island, Philippine Islands.	Jan. 28, 1904	E. A. Mearns.	303	140	59	27
U.S.N.M. 191382[1]..	...do[2]...	Pata Island, off Sulu Island, Philippine Islands.[3]	Nov. 25, 1903	.....do.........	325	162	60.5	28
U.S.N.M. 191381[1]..	Female.	.....do.[3]............	.....do........	.....do.........	322	168	57.5	27
U.S.N.M. 190573[1]..	...do.....	Mati, Mindanao Island, Philippine Islands.[3]	Oct. 23, 1903	.....do.........	327	142	56.5	27
U.S.N.M. 190572[1]..	...do.....	.....do...............	.....do........	.....do.........	.....	155	55	25
M.C.Z. 41225[1].....	...do.....	Zamboanga, Mindanao Island, Philippine Islands.	Nov. 2, 1887	E. L. Moseley.	303	137.5	56	27.5
U.S.N.M. 200677[1]..	...do.....	Three islets off Sibutu Island, Philippine Islands.	Jan. 5, 1906	E. A. Mearns.	.....	.....	57	26
U.S.N.M. 200678[1]..	...do.....	.....do.[3]............	.....do........	.....do.........	313	157	57.5	26

THALASSEUS BERGII PELECANOIDES (King).

Sterna pelecanoides KING, Surv. Intertrop. and Western Coasts Aust., vol. 2, 1827, p. 422 (Australia: i. e., Torres Strait, northern Queensland).

Sterna bergeri [sic] ("LECHT." [lege "Licht."]) RAMSAY, Proc. Linn. Soc. New South Wales, 1878, p. 301 (based on "Gould, Bds. Aust. Handbook, II, p. 394, sp. 601") (Torres Strait, northern Queensland).

Subspecific characters.—Similar to *Thalasseus bergii halodramus*, but decidedly larger.

Measurements.—Wing, 323–355 (average, 337.5) mm.; tail, 130–161 (147.7); exposed culmen, 55.5–66.5 (61); tarsus, 24.5–30 (27.6).[4] Wing, 325–361 (343.1).[5]

Geographical distribution.—The East India islands, Melanesia, and northeastern Australia. Resident north to the Marshall Islands, Admiralty Islands, New Guinea, Gilolo Island, Celebes, Borneo, and the Natuna Islands; west to the southern Malay Peninsula and Sumatra; south to Java, Savu Island, the Aru Islands, Queensland, and the island of New Caledonia; and east to the New Hebrides and the Solomon Islands.

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[1] Used in measurement averages on p. 522.

[2] Type.

[3] Wing tips slightly worn.

[4] Eight specimens, from the East India islands.

[5] Twenty-nine specimens, from the East India islands, the Admiralty Islands, and the Louisiade Archipelago, measured by Stresemann.

Notwithstanding its great geographical range, this form appears, from our material, not to be divisible into further races. It is in color near *Thalasseus bergii bergii*, but is darker and also considerably smaller.

The *Sterna bergeri* of Ramsay[1] is apparently a *lapsus calami*, or an emendation of *Sterna bergii* Lichtenstein,[2] but has for its basis the *Thalasseus cristatus* of Gould,[3] which is the bird from Torres Strait.

The specimens of this subspecies examined measure as follows:

Measurements of specimens of Thalasseus bergii pelecanoides.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
U.S.N.M. 219122[4]	Male	Batavia Bay, Java	July 11, 1909	W. Palmer	351	142	66.5	29
U.S.N.M. 171029[4]	do	Pulo Kelong, Anamba Islands.	Aug. 30, 1899	W. L. Abbott.	323	158	59	24.5
U.S.N.M. 171010[4]	do	Pulo Mata, Anamba Islands.	Aug. 28, 1899	do	324	161	60	26.5
U.S.N.M. 219121[4]	Female	Batavia Bay, Java	July 11, 1909	W. Palmer	335	130	62.5	30
U.S.N.M. 180422[4]	do	Tanjong Pingi, Billiton Island.	July 28, 1904	W. L. Abbott.	336.5	160	59.5	29
U.S.N.M. 174653[4]	do	Pulo Laut, Natuna Islands.	Aug. 3, 1900	do	338	132	55.5	27
U.S.N.M. 174652[4]	do	do	do	do	355	139	64	28
U.S.N.M. 220199[4]		Welcome Bay, Bantam, Java.	——, 1910	W. Palmer		159.5	61	27

THALASSEUS BERGII RECTIROSTRIS (Peale).

Sterna rectirostris Peale, United States Explor. Exped., vol. 8, 1848, p. 281, pl. 75, fig. 2 (Fiji Islands).

Subspecific characters.—Similar to *Thalasseus bergii pelecanoides*, but upper parts paler in both adult and young.

Measurements.—Wing, 332 mm.; tail, 147; exposed culmen, 61; tarsus, 26.5.[5] Wing, 342–362 (average, 349.8).[6]

Geographical distribution.—Polynesia. Resident north to the Phoenix Islands; west to the Fiji Islands; south to the Tonga Islands and the Society Islands; and east to the Paumotu Islands and the Marquesas Islands.

The type of this race, described by Peale,[7] is in juvenal plumage, and has been mounted, but is still in a good state of preservation. Our material, however, is not alone sufficient for the recognition of *Thalasseus bergii rectirostris*; but Mr. Gregory M. Mathews assures me that, after again examining the series available to him, he is still confident of its validity on the characters above given.

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[1] Proc. Linn. Soc. New South Wales, 1878, p. 301.

[2] Verz. Doubl. Zool. Mus. Berlin, 1823, p. 80.

[3] Handb. Birds Aust., vol. 2, 1865, p. 394.

[4] Used in measurement averages on p. 523.

[5] One specimen, from the Paumotu Islands.

[6] Five specimens, from the Fiji, Tonga, Union, and Society Islands, measured by Stresemann.

[7] U. S. Explor. Exped., vol. 8, 1848, p. 281, pl. 75, fig. 2.

The specimens examined in the present connection measure as follows:

Measurements of specimens of Thalasseus bergii rectirostris.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
M.C.Z. 48302[1].....	Female.	Mangareva I., Paumotu Islands.	Feb. 1, 1905	H. B. Bigelow.	332	147	61	26.5
U.S.N.M. 15697....	Juvenal.	Fiji Islands[2]........	....	U. S. Exploring Expedition.	295	121	40.5	26.5

THALASSEUS BERGII POLIOCERCUS (Gould).

Sterna poliocerca GOULD, Proc. Zool. Soc. Lond., 1837, p. 26 (Tasmania).

Sterna Novæ-Hollandiæ PUCHERAN, Rev. et Mag. Zool., 1850, p. 545 (Cuvier MS.) (Australia) (not Stephens).

[*Pelecanopus*] *nigripennis* BONAPARTE, Comptes Rend. Acad. Sci., vol. 42, 1856, p. 772 (nom. nov. pro *Sterna novaehollandiae* "Cuvier" [i. e., Pucheran]) (Australia[3]).

Subspecific characters.—Similar to *Thalasseus bergii pelecanoides*, but averaging darker and slightly smaller.

Measurements.—Wing, 285–350 (average, 329.7) mm.; tail, 131–179 (156.9); exposed culmen, 55-66 (59.6); tarsus, 26.5–31 (27.9).[4] Wing, 326–353 (342.1).[5]

Geographical distribution.—Coasts of New South Wales, Victoria, and South Australia, south to Tasmania.

Although this race is very close to *Thalasseus bergii pelecanoides*, in both color and size, it is probably worth keeping separate on the characters given above. It is to be noted that the present form is *darker*, not lighter, than *Thalasseus bergii pelecanoides*, but is really somewhat smaller, as writers have commonly credited it with being. It is, however, paler than either *Thalasseus bergii velox* or *Thalasseus bergii cristatus*, as well as much smaller than the first mentioned. It is darker than *Thalasseus bergii bergii*, and, of course, decidedly smaller.

The name commonly applied to this race, when it is differentiated from *Thalasseus bergii bergii* and *Thalasseus bergii pelecanoides*, is *Sterna bergii poliocerca;* and the subspecific term *poliocerca* is apparently correct, since *Sterna novaehollandiae* Stephens[6] is, as Mr. G. M.

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[1] Used in measurements on p. 524.

[2] Type.

[3] Since *Pelecanopus nigripennis* Bonaparte is merely a substitute name for *Sterna novaehollandiae* Pucheran it must have the same type-locality; and therefore Mr. Stresemann's designation of Tasmania as the type-locality (Novit. Zool., vol. 21, Feb. 25, 1914, p. 58), can not stand.

[4] Nine specimens, from Australia and Tasmania.

[5] Thirteen specimens, from southern Australia and Tasmania, measured by Stresemann.

[6] *Sterna Novæ Hollandiæ* Stephens, Shaw's Gen. Zool., vol. 13, pt. 1, 1826, p. 161 (Australia).

Mathews has discovered, properly applicable to the Australian form of *Sterna anaetheta.*

Detailed measurements of specimens examined are as follows:

Measurements of specimens of Thalasseus bergii poliocercus.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	*mm.*	*mm.*	*mm.*
U.S.N.M. 71684[1]	Male	Illawarra, New South Wales, Australia.			350	160	63	28
M. C. Z. 8781[1]	do	Tasmania		W. Robertson.	334	158	59.5	31
M. C. Z. 8782[1]	Male?	do		do	340	146	59	30
U.S.N.M. 211896[1]	Female	Bass Strait, Victoria, Australia.			285	158	55	27.5
M. C. Z. 12018[1]	Female?	Melbourne, Victoria, Australia.		J. McCoy	332	173	56	27
M. C. Z. 27589	Juvenal.	Tasmania			320	131	43.5	26.5
M. C. Z. 56054[1]		Australia	Jan. 3, 1897	M. J. Flood	328	131	66	27
M. C. Z. 56055[1]		do	July 30, 1897	do	320	142	55	26.5
M. C. Z. 56056[1]		do	Dec. 29, 1896	do	337	179	63	27
M. C. Z. 56057[1]		do	Feb. 7, 1897	do	331	165	59.5	27

THALASSEUS BERGII GWENDOLENAE (Mathews).

Sterna bergii gwendolenae MATHEWS, Novit. Zool., vol. 18, January 31, 1912, p. 208 (Rockingham, Western Australia).

Subspecific characters.—Like *Thalasseus bergii poliocercus* and *Thalasseus bergii pelecanoides*, but decidedly larger, and with upper parts paler than either.

Measurements.[2]—Wing, 343–377 (average, 360) mm.

Geographical distribution.—Coasts of western and northwestern Australia. Resident, south to southwestern Western Australia, and north to the western part of the Northern Territory (Melville Island).

This form I have not been able to examine, but judging from the descriptions and measurements given by Mr. Mathews[4] and Mr. Stresemann,[3] it is a valid subspecies. Birds from Melville Island in the Northern Territory of Australia, though close in geographical position to the range of *Thalasseus bergii pelecanoides*, are apparently much nearer *Thalasseus bergii gwendolenae*, at least in so far as their size is concerned, and probably are best referred to the latter, as already indicated by Mr. Stresemann,[4] notwithstanding their northern locality, which is, as a matter of fact, not so very far beyond the northern part of Western Australia, whence come other examples of *Thalasseus bergii gwendolenae*. The wings of five specimens from Melville Island, as given by Mr. Stresemann, range from 346 to 365 mm., with an average of 357 mm.

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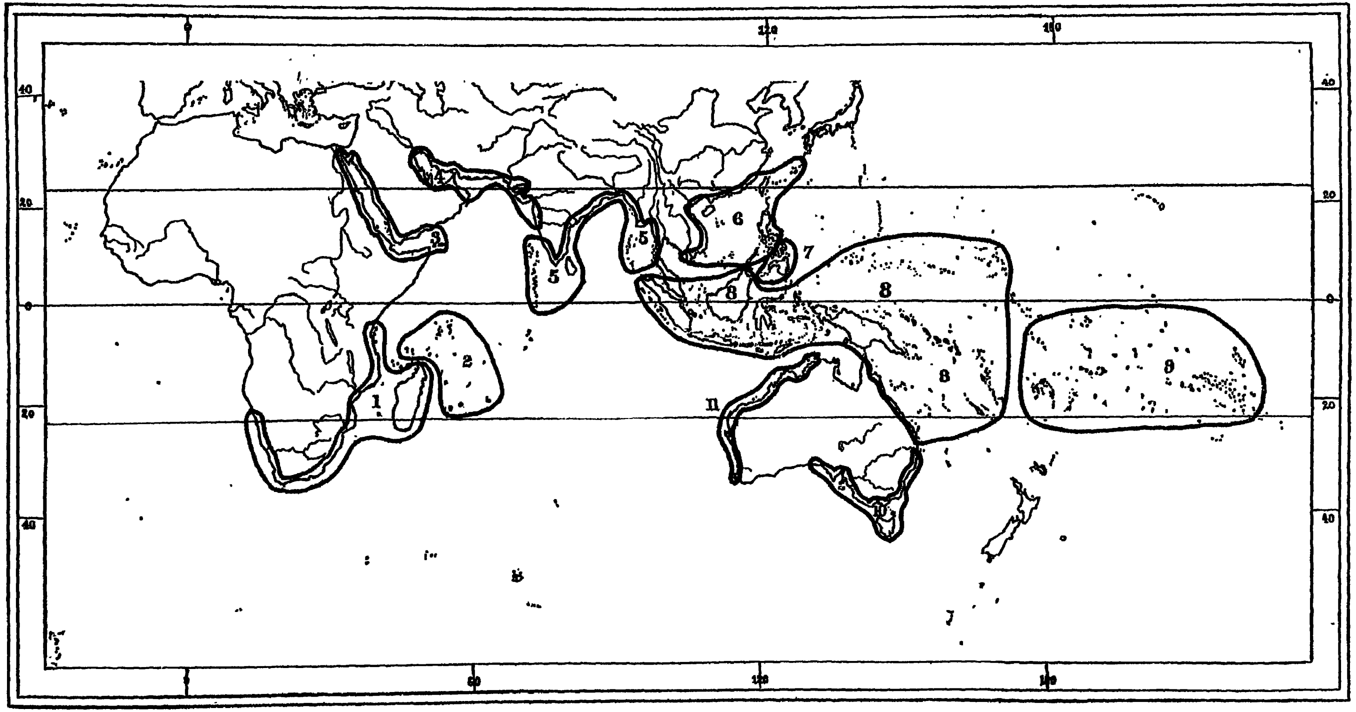
[1] Used in measurement averages on p. 525.

[2] Eight specimens, from Western Australia, measured by Stresemann.

[3] Novit. Zool., vol. 18, Jan. 31, 1912, p. 208; Birds of Australia, vol. 2, pt. 3, Sept. 20, 1912, p. 347.

[4] Novit. Zool., vol. 21, Feb. 25, 1914, p. 58.



RANGES OF THE SUBSPECIES OF THALASSEUS BERGII

1. Thalasseus bergii bergii.
2. Thalasseus bergii thalassinus.
3. Thalasseus bergii velox.
4. Thalasseus bergii bakeri.
5. Thalasseus bergii edwardsi.
6. Thalasseus bergii cristatus.
7. Thalasseus bergii halodramus.
8. Thalasseus bergii pelecanoides.
9. Thalasseus bergii rectirostris.
10. Thalasseus bergii poliocercus.
11. Thalasseus bergii gwendolenae.

THREE NEW SPECIES OF ANODONTITES FROM BRAZIL.

By William B. Marshall,

Assistant Curator, Division of Marine Invertebrates, United States National Museum.

Among some Brazilian naiads recently sent to the United States National Museum for identification by Mr. Dias da Rocha of Ceara, Brazil, were two species of Anodontites which appear to be new. They are from Ceara, Brazil. They are not represented in the Museum collection, nor in the collection of the Academy of Natural Sciences of Philadelphia, which I have examined, with the kind assistance of Dr. H. A. Pilsbry. I have been unable to find them described in the literature relating to the genus and have concluded that they belong to an undescribed species. More recently, Mr. da Rocha has sent four additional valves of Anodontites from the same locality. Two of these belong to typical *Anodontites sinuosus* Lamarck, while the other two belong to a new species.

The following descriptions and figures will serve to define the three species:

ANODONTITES SALMONEA, new species.

Plate 67.

Shell moderately thick, rounded in front, obtusely angular behind, widest just posterior to the beaks. Periostracum thin, with a dull polish, marked by obscure rays which are formed by a ruffling of the periostracum itself. Entire surface of the shell marked by concentric impressed lines, which, in the earlier stages of growth are more regular, stronger, and nearly evenly spaced, but which become faint and irregular as growth progresses. Periostracum light yellowish olive, the rest stages indicated by dark lines, and the color gradually darkens from the beaks to the margins. Posterior ridge rounded, but little elevated. Posterior dorsal area with a low rib running from the beak to a point above the posterior angle. Beaks eroded, salmon pink, and this color shows through the periostracum for some distance from the beaks, showing that the material of the shell itself is of this color. Nacre beautiful salmon pink, the color deepest in the cavity of the beak, and becoming paler and more iridescent toward the margins. Prismatic margin dull greenish, or whitish tinged with green. Surface of the nacre marked by innumerable fine radiating lines which are part of the nacre or of the shell substance.

Hinge line slightly arched and not making a sharp angle with the anterior and posterior margins. Sinulus small but very prominent and almost an equilateral triangle.

The type, Cat. No. 273688, U.S.N.M., is a single valve, probably nearly adult, from Ceara, Brazil, and measures: Length, 66 mm.; breadth, 38 mm.; diameter, if both valves were present, would be 24 mm. There is also a younger specimen, whch measures: Length, 39 mm.; breadth, 22 mm.; diameter, 14 mm.

This species shows no close relationship to any described species. Its nearest relative is *Anodontites wymani* Lea, but the two species differ in form, color of periostracum and nacre, and especially in the color of the prismatic margin. The sinulus of *wymani* is long and narrow, while that of *salmonea* is nearly an equilateral triangle. The hinge plate of *wymani* is short, broad, and heavy; that of *salmonea* is longer, narrower, and lighter.

ANODONTITES DAROCHAI, new species.

Plate 68.

Shell very thin and fragile, somewhat inflated, regularly rounded in front and angulately rounded behind, somewhat constricted just in front of the middle. Widest near the posterior end of the hinge line. Beak eroded, upper portion of each valve with numerous, obscure, evenly spaced, channeled lines. Periostracum thin, smooth, polished, greenish olive, with the rest periods indicated by a brownish line. Posterior ridge evenly rounded. Posterior dorsal area dark green with two darker green rays. Many other green rays over the entire surface which are widest and darkest posteriorly, while anteriorly they are narrow and faint.

Nacre highly iridescent, suffused with a lurid cast, marked by fine radiating lines in the texture of the shell. Channeled concentric lines of the outer surface showing through. Hinge line straight, making abrupt angles with the anterior and posterior margins. Cavity of the beaks and vicinity of the sinulus diseased, and this disease obscures the character of the sinulus.

The type, Cat. No. 273687, U.S.N.M., is a single valve from Ceara, Brazil. It is not yet fully adult. It measures: Length, 75 mm.; breadth, 45 mm.; diameter, if both valves were present, would be 24 mm.

It is named in honor of the donor, Mr. Dias da Rocha.

A young specimen from the same place sent by Mr. da Rocha possibly belongs to this species, but has a bluish nacre and a light greenish periostracum. *Anodontites sinuosus* is the nearest relative of this species. The former is nearly truncate posteriorly, while the latter is somewhat nasute, and the two species differ in other respects, but it is possible that a large series of specimens would show *A. darochai* to be a variety of *A. sinuosus*.

ANODONTITES AURORA, new species.

Plate 69.

Shell elongately subquadrate, regularly rounded in front, angularly rounded, but somewhat attenuated, posteriorly. Early shell with concentric, channeled lines, posterior dorsal area with evenly spaced, concentric, channeled lines which fade out just in front of the posterior ridge. Anteriorly the shell is nearly smooth. Posteriorly there is a succession of low, broad concentric ribs. Color brownish-olive, glossy, darkening anteriorly to light brown; posterior area very dark brown, almost blackish, the dark color here sharply differentiated from the lighter color of the rest of the shell; entire surface more or less marked with radiating brown lines varying in width and intensity; rest periods five, indicated by darker brownish lines.

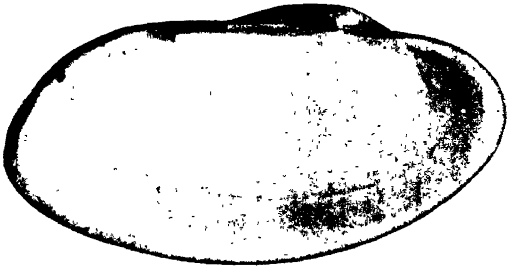
Nacre highly iridescent, with a lurid cast, marked by innumerable radiating straiae, which are in the texture of the shell. Cavity of the beak shallow. Upper portion of nacre, including the hinge line, blotched with lavender. Prismatic margin very narrow, bluish-white. Hinge line nearly straight, making an abrupt angle with the anterior margin of the shell, but scarcely any angle with the posterior margin.

The type, Cat. No. 273689, U.S.N.M., consists of a single valve which measures: Length, 110 mm.; height, 86 mm.; diameter, if both valves were present, would be 34 mm. It and one other valve come from Ceara, Brazil.

Superficially this species seems to be most nearly related to *Anodontites trapezialis* Lamarck, but a careful study of form, nacre, color, and other characters shows a closer relationship to *Anodontites sinuosus* Lamarck. *Anodontites trapezialis* narrows in front to such a degree as to give the shell a generally oblique appearance. The narrowing in *A. aurora* is much less, and hence the shell has a more quadrate form. The difference in the thickness of the two species is very great, *trapezialis* being much the thicker and much heavier. The nacre of *trapezialis* is dull, bluish-white while that of *aurora* is highly iridescent and has a lurid cast. In nacre *A. aurora* agrees in practically all respects with *A. sinuosus*.

A. sinuosus has a generally pathologic appearance. The nacre is blotched with purplish-brown and the posterior portion of the shell is rudely constructed and looks like a "bad job." *A. aurora* has the purplish blotches on the nacre, but the posterior portion of the shell neatly finished. It is possible that *A. sinuosus* if grown to perfection would possess the elongated form of *A. aurora* and that the latter would then prove to be a variety of the former.

The name *aurora* is appropriate for the species because of the play of brilliant colors in the nacre.



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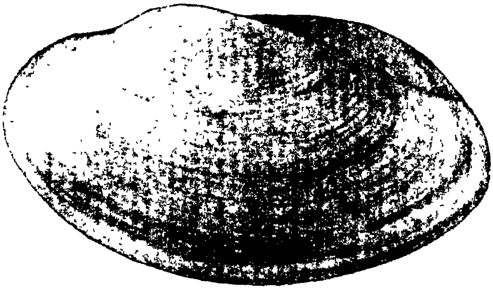

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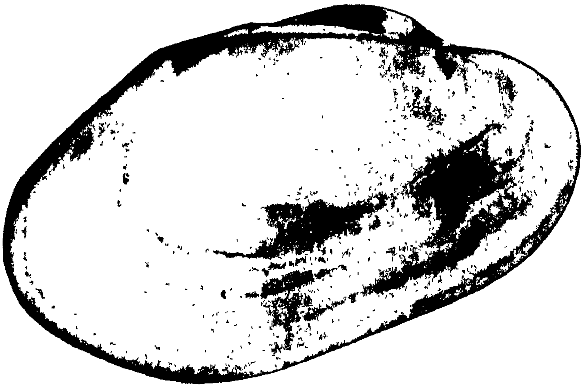
ANODONTITES SALMONEA.

FOR EXPLANATION OF PLATE SEE PAGE 527.



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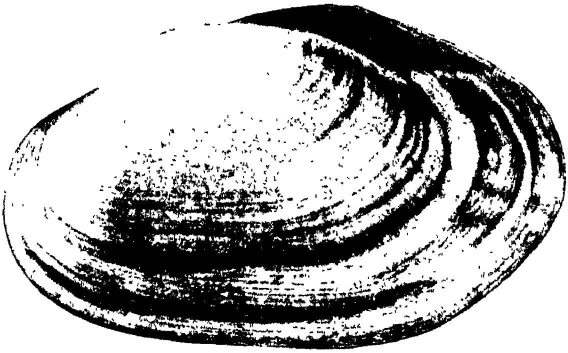

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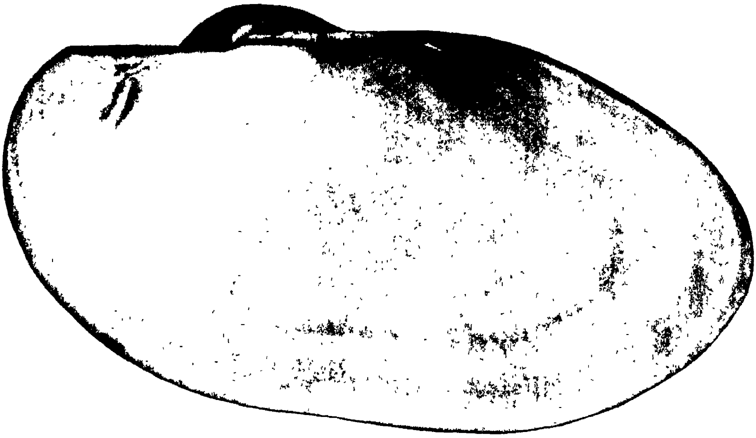
ANODONTITES DAROCHAI.

FOR EXPLANATION OF PLATE SEE PAGE 528.



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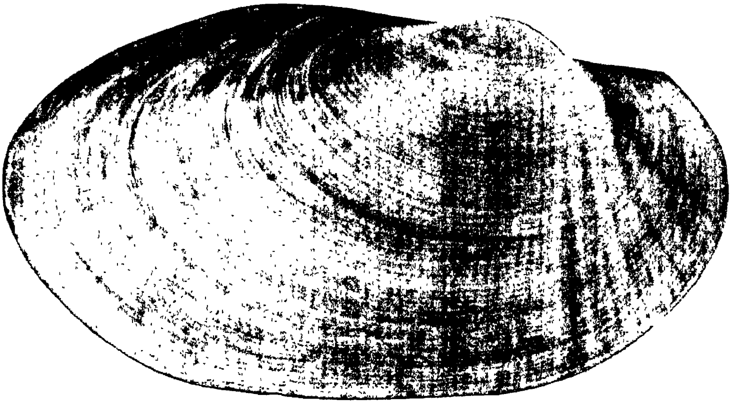

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ANODONTITES AURORA

FOR EXPLANATION OF PLATE SEE PAGE 529.

AN ACCOUNT OF THE CRUSTACEA COLLECTED BY THE WALKER EXPEDITION TO SANTA MARTA, COLOMBIA.

By A. S. Pearse,

Honorary Curator of Crustacea, University of Michigan.

INTRODUCTION.

The Crustacea of Colombia have been studied now and then, and some species have been described which are not known to occur elsewhere, but no one has ever visited the country for the express purpose of studying its carcinological fauna. It was with great pleasure, therefore, that the writer accepted an invitation to accompany the Walker Expedition, sent during the summer of 1913 by the Museum of Zoology, University of Michigan, to investigate the region about Santa Marta, on the southern shore of the Caribbean Sea. A general account of the country has been published elsewhere (Pearse, '14).

This part of South America offers an admirable variety of habitats. The map (fig. 1) gives the general features of the country. Along the coast there is a strip of desert about 7 miles wide, the flora of which consists largely of acacias and great cacti. Beyond this the mountains rise abruptly to the snow peaks of the Sierras. From July 1 to 26 the party made its headquarters on the Cincinnati Coffee Plantation, at an altitude of 4,500 feet, whence it was possible in a single day to tramp to the top of San Lorenzo (8,300 feet) and return, or to go down to Minca (2,000 feet). The mountains were covered with a luxuriant forest and it rained every afternoon. From July 28 to August 4 we studied the fauna about "La Rosa," an irrigated tract of land in the midst of a desert, the aridity of which was relieved somewhat by swift streams originating in the mountains above. From the desert we went to Fundacion, a village on the bank of a good-sized river which flowed rapidly over a sandy bottom. Here it was extremely hot and there was rain only twice during the two weeks of our stay. The surrounding country was rather dry and sandy; the forest being less dense than in the mountains above. Two days, August 22 and 23, were spent in the mangrove swamps along the Cienaga Grande on Tasajera Isla. After that (August 25 to 30) headquarters were made in Santa Marta and the sluggish rivers in that vicinity were explored. A trip was also made to Gaira, a village down the coast near the mouth of a river.

Through the indulgence of the chief of the expedition the writer was able to devote his whole time to the collection and study of crustaceans, and, as a thorough search was made in each locality visited, the list of species is believed to be representative. My thanks are due to Dr. A. G. Ruthven, who led the expedition, and to Mr. F. M. Gaige, who completed the party. Both were constantly on the alert for crustaceans and helped very materially in securing specimens and notes. My thanks are also due to Miss Mary J. Rathbun, who read the manuscript of this paper, gave many valuable suggestions, and furnished photographs for the figures of the crabs appearing in this paper.

CRUSTACEAN HABITATS.

The crustaceans of Colombia live in a variety of habitats. The aquatic representatives may dwell in the cool swift torrents on the tops of mountains, in the sluggish meandering streams of the lowlands, or among the luxuriant vegetation in the swamps. Terrestrial crustaceans may live in bromeliads, in the rough bark of trees, among fallen leaves, under logs, in rotting tree trunks, in the ground or on its surface. Some crabs and isopods are amphibious, wandering from land to water and back again as suits their convenience. The habitats in the vicinity of Santa Marta may be grouped under the following headings: Ocean, mangrove swamps, streams, forest, desert.

No attempt is made in this paper to consider the marine Crustacea, but it is impossible to study those of land or fresh water without discussing many marine crabs, such as the Gecarcinidae, Ocypodidae, Grapsidae, and Coenobitidae, which wander about on the banks of estuaries (*Uca, Gecarcinus*), climb among the mangroves (*Sesarma*), or migrate far inland along the banks of rivers (*Cardisoma*).

The mangrove swamps along the Cienaga Grande swarmed with fiddler crabs (*Uca mordax* and *U. minax*), which live in holes in the mud among the thickly crowded aerial roots. Sesarmas (*S. roberti*) climbed about over the mangroves, dodging beneath roots or into their holes when disturbed. These mangrove crabs have a habitat which furnishes them an abundance of food, but they often fall a prey to the herons and raccoons, which are extremely common.

The streams near Santa Marta are of two sorts: (1) Swift mountain torrents flowing over solid rock or bowlders, and (2) the slow-flowing rivers of the flat country along the coast. The rapid-flowing mountain streams contain no proper crustacean fauna, though the amphibious crabs, *Pseudothelphusa*, and isopod, *Philoscia nitida*, are often found there. Both these crustaceans are also of frequent occurrence on land at considerable distances from water. As soon as the streams lose the impetus of their descent from the mountains, however, they are invaded by a horde of shrimps and prawns. The favorite resort of the strange *Atya scabra* is among the collections of leaves and other

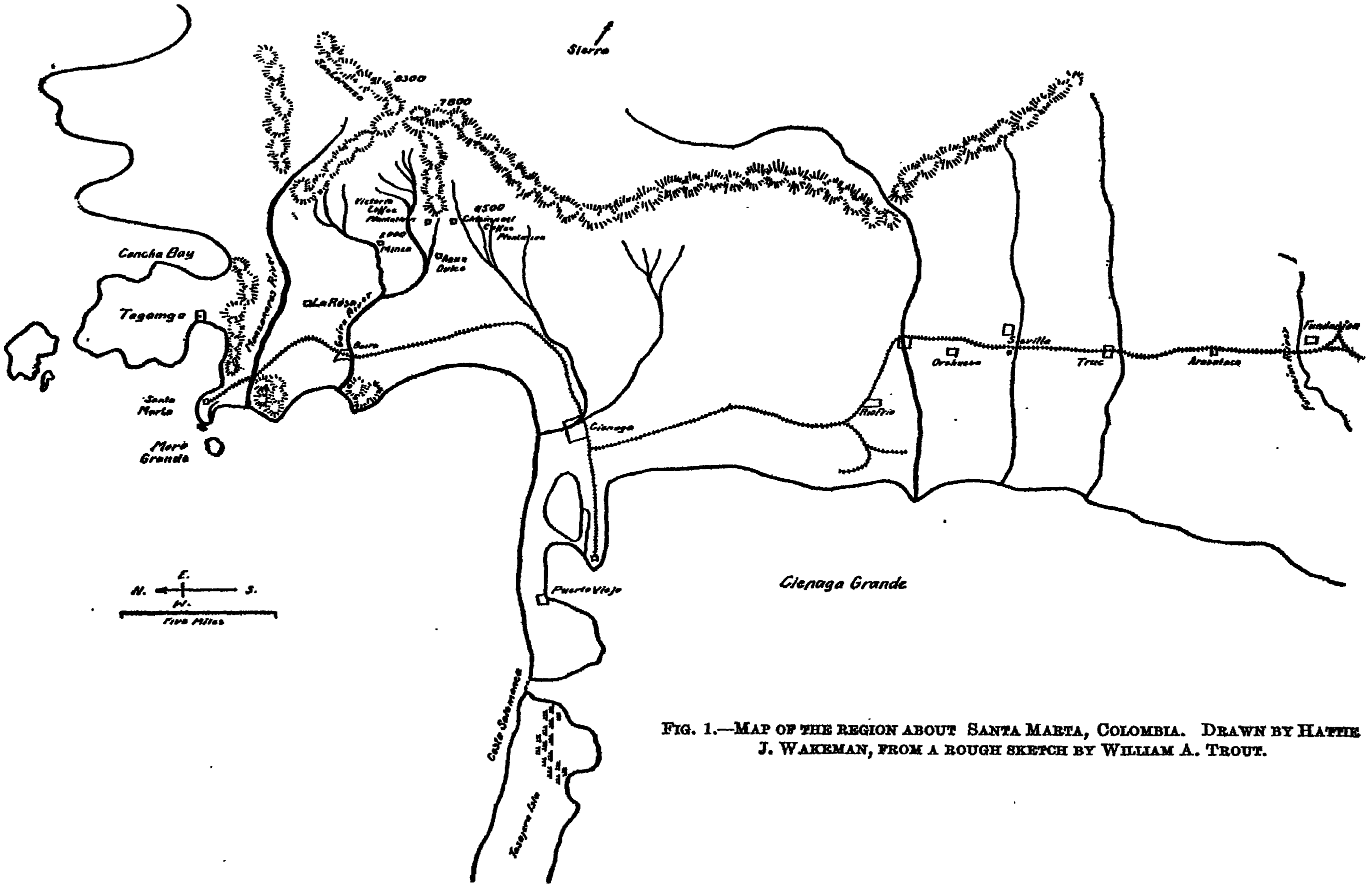

FIG. 1.—MAP OF THE REGION ABOUT SANTA MARTA, COLOMBIA. DRAWN BY HATTIE J. WAKEMAN, FROM A ROUGH SKETCH BY WILLIAM A. TROUT.

débris which catch on logs or sticks. Here they spread the nets on their claws and scrape up the organic sustenance which the surrounding water contains. Prawns, great and small, lurk under stones or logs or secrete themselves in the vegetation along the shores.

Swamps supported an abundance of entomostracans, but with the exception of an occasional fresh-water crab (*Trichodactylus quinquedentatus* or *T. dentatus*), no higher Crustacea were found. Ostracods crawled over the floating vegetation, copepods and cladocerans often swarmed in the water. Around the margins of swamps land crabs were often abundant, living in short burrows beneath logs.

The rain forest had a greater variety of crustacean inhabitants than any other region. This was to be expected if the variety of habitats and the abundance of food were considered. The most widely distributed genus was *Philoscia*, *P. nitida*, being the most abundant species. This isopod was usually found in rather damp places—under stones in brooks; along the edges of streams; on the ground under leaves, sticks, logs, or stones; in bromeliads; and on trees. When the foraging ants invaded the forest it could be seen fleeing over the ground or up the trunks of trees. *P. walkeri* and *P. culebrae* were less abundant. They were found under logs or leaves. *Ligyda richardsonae* was very common and resembled *Philoscia nitida* in its habits. The usual haunt of *Cubaris brevispinis* was under the scaly bark of a certain tree with an extremely rough trunk, though it was sometimes found on the ground under leaves or logs. Other species of isopods frequented rotten logs or the ground under fallen leaves. *Minca ruthveni* was extremely abundant in such situations. The forest crabs in the region about Santa Marta were *Pseudothelphusa pearsei* and *P. clausa*, which were common everywhere at the Cincinnati Coffee Plantation—under logs far from water, in streams, walking over the ground during showers.

In the desert along the coast there were no characteristic crustaceans except *Coenobita diogenes* which wandered about among the sparse vegetation in rocky situations. Nevertheless, there were a number of crustaceans in the desert. Along the streams where the forest crept down into the lowlands some characteristic species from above were found (*Philoscia culebrae*, *Cubaris brevispinis*, etc.). Some crabs (*Trichodactylus dentatus*, *T. pictus*, *T. quinquedentatus*) which were not met in the forest at higher altitudes were also found along these streams. In the water itself there were the shrimps and prawns characteristic of larger streams.

REMARKS ON THE ECOLOGY OF CRUSTACEA.

It is interesting to observe how in their habits different types of animals cling to racial traditions. Many of the Amphibia, such as the toads and tree frogs, are truly terrestrial, yet most of them go back to the water during the breeding season. On the other hand.

the Reptilia all breed on land; even the marine turtles and sea snakes which spend their lives in the open ocean come back to the shore to lay their eggs. Among invertebrates representatives of but two phyla have taken generally to terrestrial habitats—the arthropods and the mollusks, both provided with a strong exoskeleton. In the Arthropoda the Crustacea hold a position like the Amphibia among the vertebrates, for they are in the midst of a transition from aquatic to terrestrial habitats. In fact this class shows every gradation in mode of life—marine, fresh-water, terrestrial, arboreal. Everything indicates that crustaceans had their origin in the ocean and subsequently invaded other habitats. What are the factors, then, which have been influential in enabling these animals to take up new modes of existence or have prevented them from doing so? How have they left the ocean and become adjusted to new habitats?

Crustaceans have two peculiarities which are of considerable ecological importance. They carry their eggs about with them so that the distribution of the various species is not closely limited by breeding conditions, as is the case with many animals which deposit eggs; as, for example, insects whose larvae require particular food plants, fishes which can nest only on certain kinds of bottom, etc. Furthermore, the class as a whole is strongly committed structurally to respiration by means of gills and this fact has apparently offered the most serious obstacle to the invasion of the land.

The lessened salinity of fresh water has apparently not been important in limiting crustaceans in their migration in streams, swamps, or lakes. Several orders are now confined almost exclusively to fresh water. Yet some species which live on land or in fresh water always go back to the ocean to breed (*Coenobita, Birgus*). On the other hand, there are many which pass their whole life cycle away from the sea (many Entomostraca, Isopoda, Potamonidae, Potamobiidae).

The food habits of Crustacea permit them to live almost everywhere. Most species are omnivorous, and they frequently do much good as scavengers. If feeding habits alone were considered, it would seem remarkable that more crustaceans have not left the ocean.

Admirable protection is afforded by the exoskeleton which not only serves as an armor but prevents desiccation. Most species lurk in holes or crevices during the day and are active at night. Those which feed in daylight have very keen vision and are quick to react to any moving object, retreating to some appropriate hiding place when threatened with danger.

In changing from salt to fresh water or from water to land respiration must undergo marked changes, and this process is therefore of great importance in considering the ecology of Crustacea. The simpler crustaceans breathe through the general body surface but the Malacostraca have generally developed special gills in branchial chambers on the thorax or in connection with the appendages. The Crustacea have clung to the gills with great tenacity and instead of acquiring some other method of respiration have in many cases evolved elaborate accessory structures to facilitate the proper operation of the gills, as in *Calappa*, *Emerita*, etc. It is interesting to note that none of the primitive crustaceans have become terrestrial. Those which have taken up their abode on land have usually been able to do so through the further modification of already specialized respiratory organs. Some terrestrial Malacostraca fill the branchial cavity with water before going on land, others have labyrinthine cavities which serve as lungs developed from the walls of the branchial chambers (*Birgus*, *Thalassina*); the land amphipods have lost the thoracic appendicular gills and breathe through the general body surface; the isopods breathe through their flattened pleopods and some have even developed tracheal tubes like those of insects on these appendages. It would have made a great difference in the racial history of the Crustacea if they had hit upon tracheae early, instead of recently in one of the groups already adjusted to a terrestrial existence. Here as everywhere in the course of organic evolution success has brought its penalty. Branchial respiration made crustaceans so successful in aquatic habitats that the race got in a rut and became so set that it could not easily adjust itself to land. This limits crustaceans to water or to moist situations; comparatively few have been able to adjust their respiratory processes so as to take their oxygen directly from the air. They are also thus exposed to the dangers which accompany the fouling or drying up of water.

In their reproductive activities the Crustacea have one peculiarity, which has already been mentioned, the habit of carrying the eggs and young during part of their development. This, with the fact that most eggs or embryos within the eggshell are quite resistant to dessication, makes possible adjustment of reproductive habits to fresh water or land. The prawns in fresh water (*Macrobrachium*) differ little from their relatives in the ocean (*Palaemon*). Many fresh-water crustaceans, however, carry the young longer than marine species of the same type (*Astacidae*), and in some the young leave the parent in practically the adult form (Potamonidae). Yet some of the most truly terrestrial species go back to the ocean to hatch their larvae (*Coenobita*, *Birgus*). When we consider the remarkable powers which the eggs of many marsh and pool inhabiting species have of resisting extreme temperature and dessication (*Branchipus*, *Diaptomus*, *Cypris*), it seems strange that no entomostracans live on land. In general there appears to be nothing about the reproductive activities of Crustacea which would prevent ready adjustment to land habitats.

. The behavior of crustaceans is such that life in any sort of a habitat might be possible. As a rule the reactions of different species are rather stereotyped and are suited to a particular habitat. Those species which are closely related taxonomically may have widely different types of behavior. Fiddler crabs are diurnal, while *Ocypode* hunts at night, yet both live in burrows along the seashore and have close systematic relationship. Isopods live in burrows in wood, cling to aquatic vegetation, run over the ground, live as parasites, or have other habitats, each involving a different *set* of reactions. *Balanus* and *Polyonyx* both get their food by net fishing, yet one is a Cirriped and the other a Porcellanid. The behavior of crustaceans shows great specificity in relation to particular habitats which indicates that the class as a whole is plastic and has been able to become adjusted to a great variety of conditions.

Summarizing the last few paragraphs, it may be said that respiration appears to be the chief factor which has kept crustaceans in aquatic habitats. Reproduction, salinity of water, protection, food, and behavior may also be of more or less importance but their influence is, as a rule, distinctly secondary.

The next point to be considered is the routes which crustaceans have followed in their migration from the ocean to other regions. I think we may assume three such highways: (1) Through the rivers to the land, (2) from ocean directly to land, (3) from marshes to swamp habitats in fresh water.

At the mouths of rivers there is a mingling of fresh and salt water and a variety of crustaceans live there, some wandering from sea to river and back. The prawns, so characteristic of the rivers in the Tropics, doubtless came originally from the ocean, for they are closely related to marine species; in fact, some species now live in both places. The crayfishes and river crabs probably followed the same route. *Cardisoma* still remains near the mouths of rivers, but other genera of river crabs (*Trichodactylus*, etc.) never enter the ocean and are found far inland. The prawns and shrimps never wander from rivers over the land, but crayfishes commonly do so and some live in holes far from water. Some crabs pass most of their time on land even when they are carrying eggs (*Pseudothelphusa*).

Along the ocean there are many crabs, isopods, and amphipods which feed between the tide marks (*Chiridotea*) or above (*Orchestia, Uca, Ocypode*, etc.), or even climb shrubs or trees in search of food (*Sesarma*), yet all of them remain near the seashore. Doubtless the terrestrial hermit crabs (*Birgus* and *Coenobita*) started in this way, but now do not return to the ocean except to breed. Calman ('11) points out that the more primitive land isopods are found nearer the sea and most of the terrestrial representatives of that group appear to have taken their way from sea directly to land. The terrestrial amphipods (*Orchestia, Talitrus*) took the same route.

Along the marsh-to-swamp-to-land route a number of crustaceans have traveled. Most entomostracans in fresh water probably came this way but have never attained as far as the land. Possibly some shrimps (*Palaemonetes*) and crabs (*Trichodactylus*) have also taken this route, the latter reaching the land.

The seclusive habits of crustaceans have been a great help to them in their landward migration. Most terrestrial species are burrowers or live under leaves or fallen logs during the day. They are thus better protected from their predaceous enemies and are less exposed to dessication. Starting on the wet beaches along the shores of the ocean or of rivers, there has been a gradual migration to damp places under stumps, stones, and leaves, and from such situations even to arboreal habitats, under bark or among foliage. In figure 2 the chief routes of travel are shown.

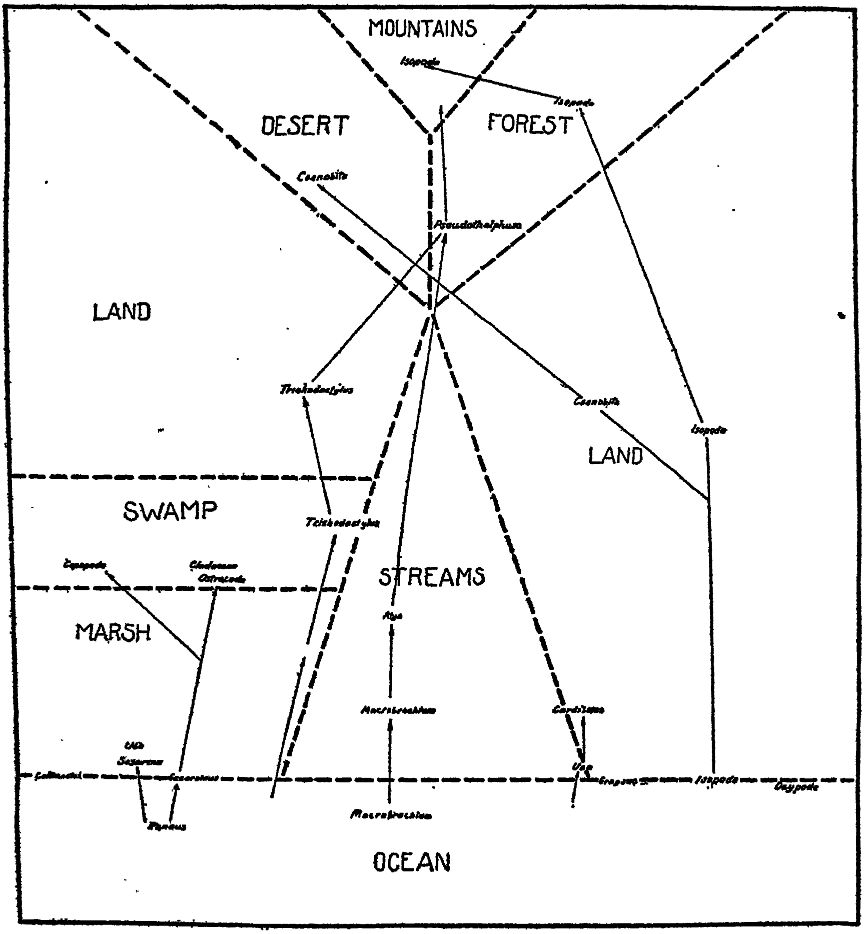

FIG. 2.—DIAGRAM TO SHOW THE CRUSTACEANS IN VARIOUS HABITATS IN COLOMBIA AND THEIR MIGRATION ROUTES.

In Colombia there is a gradual decrease in the number of species of crustaceans in going from the shore inland. In the present paper 14 species are recorded from Santa Marta on the coast, 16 at Fundacion in the low country a little way back, 10 at "La Rosa," which is about 7 miles from Santa Marta, 12 at the Cincinnati Coffee Plantation at an altitude of 4,500 feet, and 4 (all isopods) on San Lorenzo (a mountain which reaches an altitude of 8,300 feet). The distribution of species in local habitats was as follows:

Forest, 15—on ground, 12; under logs, 10; near streams, 9; in trees, 3; in bromeliads, 2.

Streams, 12—larger rivers, 8; mountain brooks, 5 (7); in pools in brooks, 6.

Swamp, 11—in puddles, 8; open water, 5; land about margin, 2.

Desert, 1—(*Coenobita*).

GEOGRAPHICAL AFFINITIES OF THE CRUSTACEANS OF THE SANTA MARTA REGION.

Of the Entomostraca collected, five of the cladocerans and the ostracod are species which have previously been taken in the southeastern United States. They will doubtless be found to have a wide distribution when their range is known. *Diaptomus marshi* has been recorded from Guatemala and Panama. *Cyclops leuckarti* and *Macrothrix laticornis* are cosmopolitan.

The shrimps and prawns are for the most part species which range from the southern United States to Brazil. *Peneus brasiliensis* ranges north to Massachusetts, and *Atya scabra* is found in Africa. *Coenobita diogenes* occurs in the West Indies, Africa, and some of the Pacific Islands.

Two genera of land crabs (Potamonidae) were collected near Santa Marta. Of the three species of *Trichodactylus*, two range east and south to Brazil, the other northwest to Nicaragua. The four species of Pseudothelphusa described by Miss Rathbun are related to species which are found south and west. The different species therefore have relations in every direction. The marine crabs are all species which have a wide range on the Atlantic coast of both Americas, some even extending to Africa and other continents.

The isopods which are not new range through Central America and the West Indies, one extending to Bermuda and the Mediterranean. Doubtless many of them reach farther to the south, but their distribution in that direction is unknown.

The crustaceans treated in this paper add nothing of great importance to what is known concerning the distribution of the carcinological fauna of South America and the West Indies. The land crabs mostly range southward, the entomostracans and isopods northward, but the latter premise may be found to be erroneous when the central and western parts of South America are better known. No amphipods were found, although a careful search was made in every locality visited. No Entomostraca were found at the Cincinnati Coffee Plantation. This was doubtless due to the fact that there was very little swampy land or standing water.

LIST OF SPECIES.

COPEPODA.

DIAPTOMUS MARSHI Juday.

Quite common in a Birge-net collection from some pools at the edge of a marsh at Fundacion, August 15. Previously recorded from Guatemala and Panama (Marsh, '13).

ACARTIA TONSA Dana.

Collected at surface of Cienaga Grande at Tasajera Isla in a tow net at 9 o'clock in the evening on August 22. Previous records from Australia, South Pacific, and Massachusetts.

CYCLOPS LEUCKARTI Claus, var. EDAX Forbes.

A common species on the lowlands. Collected in Birge-net as follows: Artificial pond, Fundacion, August 9, 11; pools along railroad, Fundacion, August 11; swamp, La Rosa, July 31; pools along railroad, Santa Marta, August 29; pool covered with duckweed in bed of Gaira River, Gaira, August 27; marsh, Gaira, August 27. Cosmopolitan.

CLADOCERA.

MOINODAPHNIA MACLEAYII Sars.

In swamps, at Fundacion, August 11, and at Gaira, August 27. Previously reported from Louisiana.

EURYALONA OCCIDENTALIS Sars.

In pools at edge of swamp, Fundacion, August 15. Previously reported from Florida, Texas, and Arkansas.

ALONELLA KARUA (King).

In pools at edge of marsh, Fundacion, August 15. Previously reported from Louisiana, Texas, and Arkansas.

MOINA BRACHIATA Jurine.

Abundant in an artificial pool, Fundacion, August 9. Previously reported from Wisconsin, Nebraska, and Missouri.

MACROTHRIX LATICORNIS (Jurine).

In the marsh at Fundacion, August 11, and in pools along the railroad at Santa Marta, August 29. Cosmopolitan.

PSEUDOSIDA BIDENTATA Herrick.

In pools at border of swamp, Fundacion, August 15. Previously reported from southern United States.

OSTRACODA.

PARACYPRIS PERELEGANS Herrick.

Common among roots of floating plants in a swamp near "La Rosa" on July 30; in a *Lemna*-filled pool in the woods near the same place, August 2; and in the marsh at Fundacion, August 11, among floating aquatic vegetation. My thanks are due to Mr. R. W. Sharpe for the identification of this species, which was originally described from Alabama.

ISOPODA.

TYLOS LATREILLI Audouin and Savigny.

A single specimen was captured on the sandy ocean beach at Santa Marta. Range: Odessa, Tunis, Algeria, Bermudas, Florida, and (now) Colombia.

PHILOSCIA CULEBRAE Moore.

Below the Cincinnati Coffee Plantation this species was abundant under leaves and logs in the forest down as far as Minca. It was also found in smaller numbers at "La Rosa," where five specimens were taken in a cane field and one in the bark of a rough-trunked tree.

This species has previously been reported only from Porto Rico (Moore, '01). The uropods were broken off the type-specimens, hence are shown here (fig. 3).

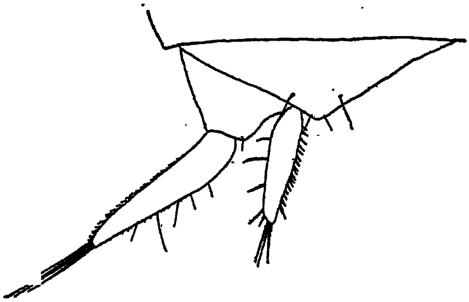

FIG. 3.—PHILOSCIA CULEBRAE. LEFT UROPOD AND TELSON.

PHILOSCIA WALKERI, new species.

Cotypes.—Cat. No. 45931, Museum of Zoology, University of Michigan. Cat. No. 47949, U.S.N.M. Collected at the top of San Lorenzo, Sierra Nevada de Santa Marta, Colombia, 8,300 feet elevation, under stones in grass, by F. M. Gaige, July 10, 1913. Orig. No. 130.

Body very slender; 4 by 1.1 mm. Head nearly one and one-half times as long as broad; front somewhat recurved between sides and middle; sides and posterior margin rounded. First segment of thorax little longer than those following, its anterior margin curved, the posterior margin nearly straight; anterior angles rounded and projecting laterally somewhat beyond the sides of the head. Next six segments about equal in length; last three with posterolateral angles produced but rounded, angles of last reaching to end of third abdominal segment. First three abdominal segments about equal in length and shorter than either the fourth or fifth; lateral parts of the first concealed by the last thoracic segment. Telson short, about as long as preceding segment, apex triangular, rounded at tip.

Eyes rather small, with 10 facets. Second antenna extending to end of third thoracic segment, spinulose; first segment short, second and third subequal in length; fourth one-fourth longer than third; fifth one-third longer than fourth; flagellum 3-segmented, without the slender terminal seta about as long as preceding segment. Mandible with 4-toothed tip; below tip are two plumose setae; lower down a brush; no palp. First maxilla with inner plate armed with two plumose processes; outer plate with eight curved spines.

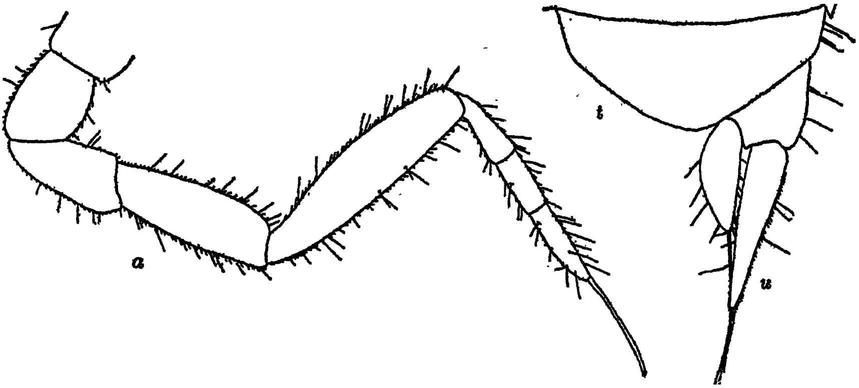

FIG. 4.—PHILOSCIA WALKERI. *a*, ANTENNA; *t*, TELSON; *u*, UROPOD.

Legs slightly increasing in length from before backward. Uropods with basal segment broad; outer ramus one-third longer than inner one, tapering; inner ramus broad, oval (fig. 4).

Color, deep brown; a broad white band across the anterior margin of each thoracic segment (these bands give the isopod a striped appearance); a patch of irregular longitudinal bands extends back from the anterior band on each side of the thoracic segments; head with many small elongated white markings. Ventral surface white. Legs white, mottled with delicate brown markings.

This species was fairly common under stones, grass, and logs, and in bromeliads at the top of San Lorenzo (8,300 feet) on July 19 and 23. Two specimens were also taken in the forest below at an altitude of about 4,500 feet.

PHILOSCIA NITIDA Miers.

This was an abundant species in the forest from "La Rosa" (fig. 1) to the top of San Lorenzo. It was usually found on the ground among leaves or under logs but was also taken on tree trunks, in brooks, and in bromeliads. At the top of San Lorenzo it was found in the ground under leaves and in a little brook that started there. Those taken at high altitudes are darker in color in alcohol.

LEPTOTRICHUS GRANULATUS Richardson.

Thirty specimens of this interesting isopod were collected—under some bricks in the patio of our house in Santa Marta; in a log in an ant's nest and under leaves in the forest at Fundacion; under the bark of a rough tree near "La Rosa." It has previously been reported only from the Bermudas, where it was found in dead coral.

CUBARIS CINCTA (Dollfus)?

A small specimen, probably referable to this species, was taken in the forest under leaves on the ground near the Cincinnati Coffee Plantation. Previously recorded from Layon, West Indies.

CUBARIS BREVISPINIS, new species.

Holotype.—Cat. No. 45981, Museum of Zoology, University of Michigan. Collected on trail above Minca, Sierra Nevada de Santa Marta, Colombia, 2,200 feet elevation, by A. S. Pearse, July 15, 1913. Orig. No. 91.

Paratypes.—Cat. No. 47944, U.S.N.M.

Body contractile, capable of being rolled into a ball; dorsal surface covered with strong spines; color brown with a narrow horn-colored margin along the lateral and posterior borders of all free somites, and with some irregular white spots. Length 9, width 4.3 mm.

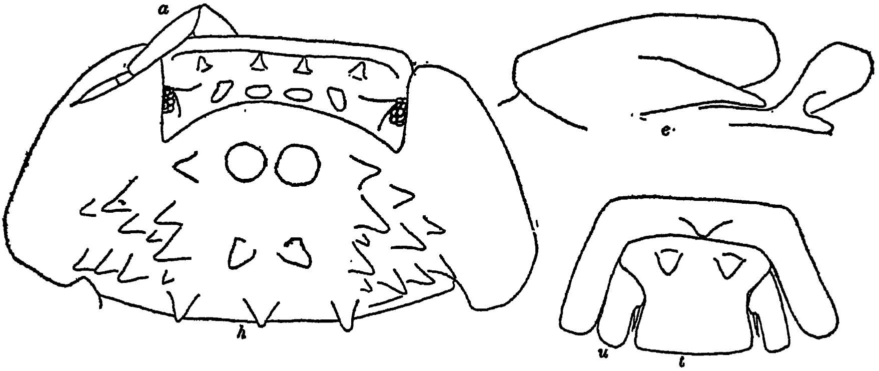

FIG. 5.—CUBARIS BREVISPINIS. *a*, ANTENNA; *e*, VENTRAL SURFACE OF FIRST TWO EPIMERA; *h*, HEAD; *t*, TELSON; *u*, UROPOD.

Head wider than long; front straight; anterolateral angles rounded. A transverse row of four small spines in front; six larger spines behind. Eyes small, rounded, with 16 facets. First antenna small and inconspicuous; second having flagellum composed of two articles, the second of which is twice as long as the first (fig. 5).

First thoracic segment with lateral parts large and laminar; anterior and posterior angles rounded; dorsal surface of epimera concave; bearing 29 spines. Near to the anterior margin are two large spines followed by a clear space, then two smaller spines and a single median spine projecting beyond the posterior border of the segment. On either side of the last are two other spines of similar size. The remaining spines are on the sides of the segment but do not come from the epimera. Each of the following six segments has 17 spines: eight across the anterior borders, three near the middle of the posterior border, two on either side of the posterior border (the inner one smaller), and two beyond all the others near the epimera on either side. All thoracic epimera produced and flattened, rectangular with rounded angles. Coxopodites distinct on first and second segments, tapering with rounded tips.

First somite of abdomen barely visible; second segment short, covered laterally by last thoracic somite, unarmed; third, fourth, and fifth somites each with a single stout median spine; sixth somite with a pair of lateral spines near base. Uropoda rather slender; outer rami small, reaching halfway to posterior margin; inner rami minute only reaching a little beyond the median constriction in the sixth abdominal somite.

The usual haunt of this little isopod was beneath the scales of a tree with extremely rough bark. Once two specimens were found under some stones in a dry creek bed. It was found at Fundacion, La Rosa, and below the Cincinnati Coffee Plantation.

CUBARIS GIGAS Miers.

Nine specimens were collected under stones at Fundacion. The color of this species is rather striking. There is a salmon-colored band along each side of the body, extending through all the thoracic epimera; dorsum with the usual lateral markings; distal half of uropoda salmon-colored. The coxopodite of the first somite is free for one-third of its length and does not reach as far back as the epimerite. There is a well-developed coxopodite on the second somite. Previously reported from Nicaragua.

MINCA, new genus.

First pair of antennae minute, triarticulate. Second pair of antennae short; flagellum biarticulate. Eyes small, composite. First maxilla with two plumose processes. First three thoracic somites with coxopodites distinct from epimera. Terminal abdominal segment triangular. Uropoda vary broad and flat, extending beyond tip of abdomen; basal segment large; entire, tetragonal; outer ramus minute, inserted near center of dorsal surface of basal segment; inner branch small, linear, not reaching to tip of basal article.

Type of genus.—*Minca ruthveni* Pearse.

This genus differs from the others in the family *Armadillidae*, (*Cubaris*, *Pseudarmadillo*) in (1) the shape of the telson, (2) the

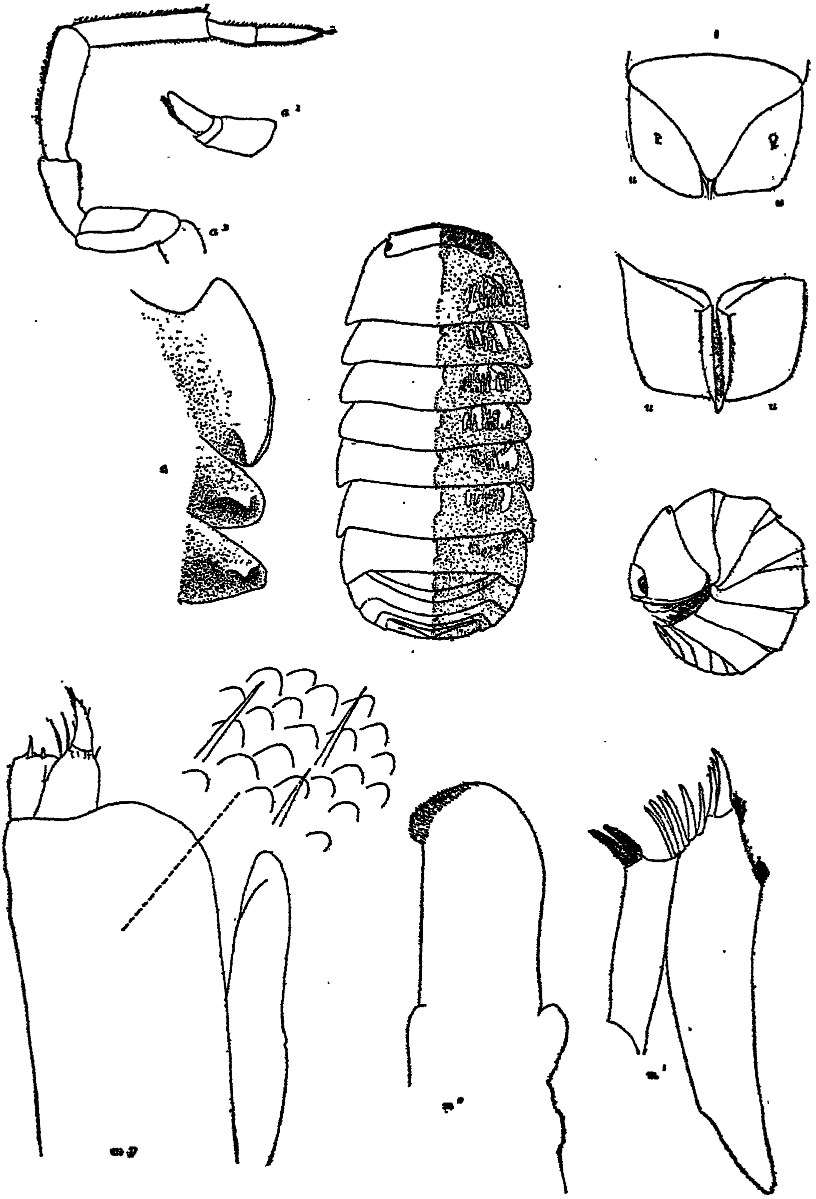

FIG. 6.—MINCA RUTHVENI. a^1, FIRST ANTENNA; a^2, SECOND ANTENNA; *e*, VENTRAL SURFACE OF FIRST THREE EPIMERA; m^1, FIRST MAXILLA; m^2, SECOND MAXILLA; *mp*, MAXILLIPED; *t*, TELSON; *u*, UROPOD.

structure of the uropoda, and (3) the presence of free coxopodites on three somites. It is named for a station at the base of the foothills near Santa Marta.

MINCA RUTHVENI, new species.

Cotype.—Cat. No. 45949, Museum of Zoology, University of Michigan. Cat. No. 47945, U.S.N.M. Collected under logs on Cincinnati Coffee Plantation, Sierra Nevada de Santa Marta, Colombia, 4,500 feet elevation, July 17, 1913. Orig. No. 111.

Body finely tuberculate, pubescent toward posterior end; length 16 mm., width 7.4 mm. Head not produced into lobes; very short, less than one-third first thoracic segment; more than four times wider than long. Eyes small oval, with about 12 facets, close to lateral margins. First pair of antennae inconspicuous; second pair with the basal segment short, second article two and a half times as long as first; third one-fifth shorter than second; fourth nearly twice third and subequal to fifth; flagellum 2-segmented, with the second segment slightly longer. First maxilla with two plumose processes.

First thoracic somite longer than any other, twice as long as second, which is subequal to the six following. Coxopodites distinct on the first three segments; on the first in the form of a long carina extending the whole length of the segment but diverging more posteriorly; on the second and third as short triangular processes.

Abdomen composed of six somites; first two covered laterally by last thoracic segment. First five somites about equal in length when measured on median line. Terminal segment triangular, obtuse, pointed; posterolateral margins slightly concave. Basal segment of uropoda laminar, tetragonal, extending beyond tip of terminal segment; external ramus minute, conical, inserted near center of dorsal surface of basal segment; inner ramus linear, acute, reaching beyond tip of sixth abdominal segment and equaling basal segment (fig. 6).

Color chocolate-brown with median spots and lateral yellowish-white markings, as shown; often the epimera on thorax have white spots.

One hundred and eighty-one specimens were collected. This species was abundant under logs on and about the Cincinnati Coffee Plantation. The contents of the stomachs of several individuals were examined through a compound microscope. The food consisted of minute bits of rotten wood and some vascular plant tissue.

SPHAERONISCUS GAIGEI, new species.

Holotype.—Cat. No. 45908, Museum of Zoology, University of Michigan. *Paratype.*—Cat. No. 47946, U.S.N.M. Collected in highest timber on San Lorenzo, Sierra Nevada de Santa Marta, Colombia, 7,800 feet elevation, under leaves in ground, July 23, 1913. Orig. No. 161.

Body oblong, convex, contour rounded posteriorly; contractile into a somewhat flattened ball; length 4.4 mm., width 1.8 mm. Head set in first thoracic segment; front sinuous, with a slight concavity on either side; lateral angles prominent. Eyes small, with 14 facets. Second antenna robust, with 3-segmented flagellum; covered with many minute setae; ultimate segment nearly as long as the two preceding together, terminal seta very long. First maxilla with two plumose processes (fig. 7.)

First segment of thorax not twice as long as head, with two transverse rows of large tubercles; longer than other segments, each of which has a row of tubercles along its posterior margin. Coxopodites not distinct. First two abdominal segments without epimera; epimera of succeeding segments continuing contour of body. Terminal segment nearly twice as broad as long, slightly concave on posterolateral margins; tip rounded. Uropoda with basal segments square but deeply notched on posterior border near median angle; external rami longer than basal segment, inner rami extending to middle of outer.

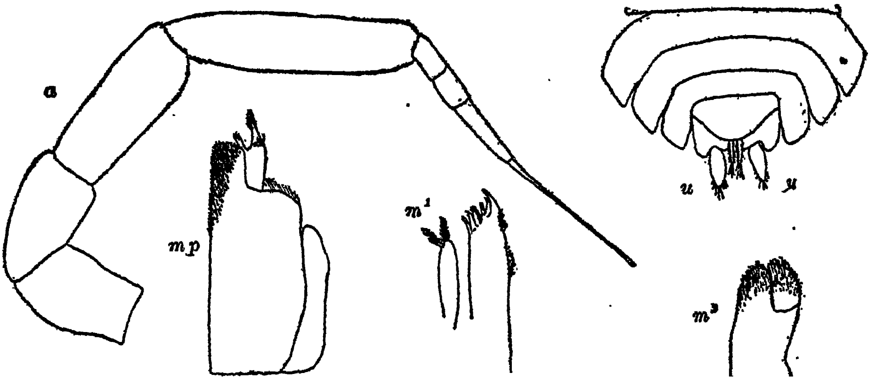

FIG. 7.—SPHAERONISCUS GAIGEI. *a*, ANTENNA; *m*¹, FIRST MAXILLA; *m*², SECOND MAXILLA; *mp*, MAXILLIPED *u*, UROPOD.

Color, reddish-brown with irregular bilaterally symmetrical markings of yellowish-white.

Seven specimens were taken in the highest timber on San Lorenzo, at an altitude of about 7,800 feet, in the ground under leaves, by Mr. F. M. Gaige, on July 23.

SPHAERONISCUS COLOMBIENSIS, new species.

Holotype.—Cat. No. 45957, Museum of Zoology, University of Michigan. *Paratype.*—Cat. No. 47947, U.S.N.M. Collected under leaves and logs in forest south of Cincinnati Coffee Plantation, Sierra Nevada de Santa Marta, Colombia, 4,800 feet, by A. S. Pearse, July 12, 1913. Orig. No. 82.

Body oblong, very convex, contractile into a ball; length 16 mm., width 5.8 mm. Dorsal surface marked with very minute pearly granules arranged in irregular anastomosing lines. Head set in first thoracic segment; front nearly straight; epistoma rhomboidal.

Eyes small. Flagellum of second antenna 3-segmented. Inner lobe of first maxilliped armed with two plumose processes (fig. 8).

First thoracic segment twice as long as head, and longer than any other segment. Coxopodites not distinct. First abdominal segment with lateral parts concealed; second without epimera but not concealed; the epimera of the next three segments continuing the general contour of the lateral margin. Telson broadly triangular, twice as broad as long, obtuse, slightly concave on posterolateral margins. Basal segments of uropoda large, square, with a notch at the mediodistal angle for the exopodite, which extends downward. The internal ramus of the uropoda slender, reaching about as far as outer ramus, longer than basal segment.

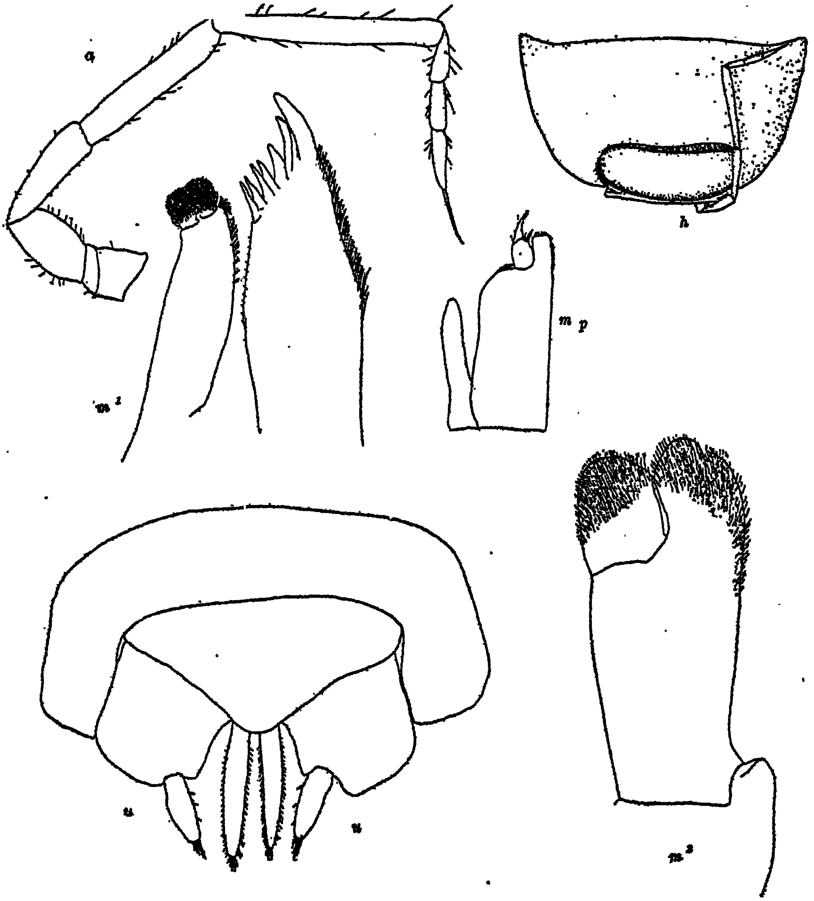

FIG. 8.—SPAERONISCUS COLOMBIENSIS. *a*, ANTENNA; *h*, HEAD AND FIRST THORACIC SEGMENT; *m*¹, FIRST MAXILLA; *m*², SECOND MAXILLA; *mp*, MAXILLIPED; *u*, UROPOD.

Color, brown, with paired lateral areas which contain irregular yellowish-white lines.

This isopod was found under stones and logs in the forest about the Cincinnati Coffee Plantation, but was not common. Females carrying young were collected on July 3 and 12.

LIGYDA RICHARDSONAE, new species.

Cotype.—Cat. No. 45721, Museum of Zoology, University of Michigan. Cat. No. 47948, U.S.N.M. Collected at Cincinnati Coffee Plantation, Sierra Nevada de Santa Marta, Colombia, 3,800 feet elevation, by A. S. Pearse, July 3, 1913. Orig. No. 18.

Body oblong-ovate, nearly three times as long as wide, 5.5 by 18.3 mm. Specimens measured vary in length from 13.3 to 18.3 mm.

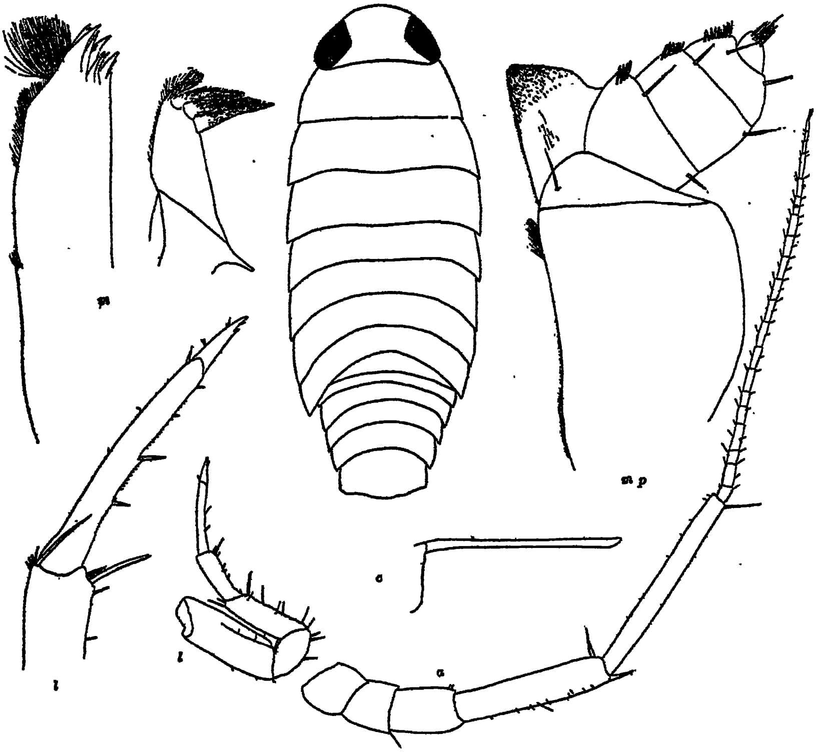

FIG. 9.—LIGYDA RICHARDSONAE. *a*, ANTENNA; *c*, COPULATORY ORGAN; *l*, FIRST LEG OF MALE; *m*, FIRST MAXILLA; *mp*, MAXILLIPED.

Color, mostly gray with a broad light band at the sides of the thorax; sometimes a few white spots along the posterior borders of thoracic segments; usually a broad rather indistinct darker band along median dorsal line. Uropoda 6.2+ mm. long (broken), slender. Dorsal surface of body smooth with a few scattered minute hairs. Head twice as wide as long, 4 by 1.7 mm.; anterior margin arcuate. Eyes elliptical; truncate on median margin; space between eyes in front more than greatest diameter of one eye; length of one eye, 1.2 mm.

First pair of antennae small and inconspicuous. Second pair of antennae with first two segments short and subequal; third segment hardly as long as first two combined; fourth segment twice as long as third; fifth one-third longer than fourth; flagellum contains about 20 segments, and reaches to end of fourth thoracic segment. Maxilliped has a palp of five articles (fig. 9).

Segments of thorax subequal, with lateral margins smooth. Epimera coalesced with segments, usually lighter in color than terga. All six segments of abdomen distinct; the first two shorter than the three following and with their lateral parts covered by seventh thoracic segment; third, fourth, and fifth segments successively larger. Sixth or last abdominal segment with lateral margins parallel; posterior margin not produced but somewhat arcuate. Abdomen narrower than thorax.

First pair of legs in male slender, with ventral border of merus finely serrate. Copulatory appendage of male slender, linear, and nearly straight. All legs ambulatory; with biunguiculate dactyli. This species resembles *L. baudiniana*, but the first legs of the male lack the armature characteristic of that species.

It was abundant in the forest from above Minca to the top of San Lorenzo. It lives in damp places, under leaves, logs, and stones, and was often found in brooks. Females carrying young were taken on July 15, 18, and 25.

PROBOPYRUS BITHYNIS Richardson.

A female of this species was found in the branchial chamber of a *Macrobrachium olfersii* (Wiegmann) collected July 29 in a stream near "La Rosa."

DECAPODA.

MACROBRACHIUM OLFERSII (Wiegmann).

This species was very common in the streams near "La Rosa" (fig. 1), in the Manzanares River at Santa Marta, and in the Gaira River. On July 29 and 31 and on August 1 large (54, 45.5, 46.3, 42.5, 47, 66.7 mm.) females carrying eggs were taken in the rivers and irrigating ditches near "La Rosa." The largest specimen captured, a male measuring 73 mm. in length, was found in a ditch at the same place. About 300 specimens of all sizes were collected.

This prawn usually rested under stones, among fallen leaves or aquatic vegetation in the larger streams. It is widely distributed through the West Indies, Mexico, Central America, Venezuela, Brazil, and West Africa.

MACROBRACHIUM ACANTHURUS (Wiegmann).

This was the only prawn collected at Fundacion, where it was common in the small sluggish streams; it was not found at any of the other localities visited. Eighteen specimens were collected. Females

(46, 30, 42.3 mm. in length) carrying eggs taken on August 8 and 14. This species ranges from Texas to Brazil. Its distribution in Colombia is apparently different from other shrimps and prawns.

MACROBRACHIUM JAMAICENSE (Herbst).

This species was quite common in the streams near "La Rosa" (fig. 1). The 20 specimens collected were secured in the streams along the margins under leaves, among vegetation, and under stones. Two females carrying eggs were taken June 30. They measured 143 and 130.5 mm. in length. This species ranges from Texas to Rio de Janeiro and is also found on the Pacific slope.

ATYA SCABRA Leach.

This peculiar shrimp was quite common in the swift streams flowing among bowlders over sandy bottoms near "La Rosa." It was found among or under bunches of dead leaves which had accumulated against sticks or stones. Females carrying eggs were often met during the first week in August. The largest of these measured 62 mm. in length; the smallest, 26 mm. Of the 79 specimens collected, the largest was 64.5 mm. long. This species is widely distributed, being found from Mexico to Venezuela and in West Africa.

PENEUS BRASILIENSIS Latreille.

A shrimp which is abundant in the Cienaga Grande. A number were purchased from a fisherman at Puerto Viejo. Most of them measured about 80 cm. long. They have 10 (9) rostral spines and the antennular peduncle slightly exceeds the tip of the rostrum. This species is found from Massachusetts to Brazil and has also been reported from West Africa.

COENOBITA DIOGENES Milne-Edwards.

On August 29 Doctor Ruthven came upon a great drove of these hermit crabs apparently migrating away from the ocean through the desert near Santa Marta. His attention was first attracted by the noise they made as they scratched along among the loose bowlders, sticks, and dry leaves. It was estimated that about 500 individuals were moving over an area about 200 meters square. Eleven specimens were preserved. All were females and eight were carrying eggs. The range of this crab extends from West Africa, through the West Indies to the Pacific Islands. Three specimens brought back alive have lived in the vivarium at the University of Wisconsin for a year.

TRICHODACTYLUS (DILOCARCINUS) DENTATUS (Randall).

This crab was common around the edge of swamps and in pools and intermittent streams at Fundacion. Near swamps they were often found in burrows under logs. These holes sometimes reached a depth of 20 cm. and often had no water in them. In the creeks the crabs were usually found under sticks or loose stones. The largest male collected measured 24.2 mm. long and 30.5 mm. wide; the largest female, 27 by 33 mm. Sixty-eight specimens were taken. This species ranges southward from Colombia through Venezuela and Guiana into Brazil.

TRICHODACTYLUS (DILOCARCINUS) PICTUS (Milne Edwards).

A single male was collected under a pile of leaves in the Fundacion River August 12. It measured 10.4 mm. long by 11 mm. wide. This species is found in Colombia, Guiana, Brazil, Paraguay, and on the upper Amazon; Young ('00) says also in Peru.

TRICHODACTYLUS (TRICHODACTYLUS) QUINQUEDENTATUS Rathbun.

This crab was abundant in little pools along the margins of the streams near "La Rosa." It also was common with *T. dentatus* at Fundacion around swamps and in small streams. Females carrying eggs were taken at Fundacion August 8 (1) and on August 11 (4). On the latter date a male and female were found together in a hole under a log. The largest female measured 19.8 by 23.5 mm. One hundred specimens were collected, the largest being a male measuring 20.9 by 25.5 mm. The range of this species is from Colombia to Nicaragua.

PSEUDOTHELPHUSA PEARSEI Rathbun.

Plate 70.

Pseudothelphusa pearsei RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 95.

This land crab was abundant on and near the Cincinnati Coffee Plantation. It was collected in the forest at altitudes from 3,500 to 5,000 feet in a great variety of habitats—walking over the ground during rains, on land under logs or stones, in brooks under stones, in burrows under stones along streams.

Paratypes.—Cat. Nos. 47950, 47952, 47953.

PSEUDOTHELPHUSA CLAUSA Rathbun.

Plate 71.

Pseudothelphusa clausa RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 98.

Quite a common species at the Cincinnati Coffee Plantation. Its altitudinal range was from 4,000 to 4,800 feet, and its habits similar to *P. pearsei.*

Paratypes.—Cat. No. 47951, U.S.N.M.

PSEUDOTHELPHUSA ANGULATA Rathbun.

Plate 72.

Pseudothelphusa angulata RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 98.

This species was collected only once under stones at the edge of a brooklet in the forest above Minca; altitude, 2,900 feet.

PSEUDOTHELPHUSA RUTHVENI Rathbun.

Plate 73.

Pseudothelphusa ruthveni RATHBUN, Proc. Biol. Soc. Washington, vol. 28, 1915, p. 100.

An adult female of this species was collected at the south end of the Cincinnati Coffee Plantation (2,500 feet).

CALLINECTES ORNATUS Ordway.

Parts of shells left by raccoons or herons were common in the mangrove swamps at Punta Gruesa along the Cienaga Grande. This species ranges from South Carolina to Brazil and is also found in the Bermudas.

SESARMA ROBERTI Milne Edwards.

These crabs had burrows among the mangroves at Punta Gruesa. They walked about over the roots or climbed in the trees. Three specimens were taken which show the following measurements in millimeters:

	Length.	Breadth ant.	Breadth post.	Front.
Male	16.6	20.2	16.3	14.3
Male	14.9	18.5	15.3	12.3
Female	14.0	17.8	15.2	12.2

This species is found throughout the West Indies and in Africa.

GRAPSUS GRAPSUS (Linnaeus).

Common on the rocks along the ocean at Santa Marta. Range, throughout the Tropics.

CARDISOMA GUANHUMI Latreille.

The holes of these great crabs were abundant on the clay flats at the mouth of the Manzanares River at Santa Marta. They were also common in holes about the roots of trees along the Gaira River at Gaira. Shells and claws from crabs of this species were picked up in the mangrove swamp at Punta Gruesa.

At the mouth of the Manzanares a careful study was made of the habits of *Cardisoma*. At night the crabs came forth in hordes, walked about everywhere over the flats, and climbed into the trees. One was seen in a tree 10 feet from the ground. In feeding the females and smaller males go about sifting the mud between both chelae, but do not pass every "handful" they grasp up to the mouth. The big males use only the smaller claw. Several times crabs were seen to eat fallen leaves from trees. One would take a leaf in his claw and start nibbling at one end, and this was continued until the whole leaf had disappeared.

When a *Cardisoma* digs he makes frequent use of his great claws, and in this respect differs from the fiddler crabs (Pearse, '12) which live on the same mud flats with him. He may dig up a lump of dirt with his chelipeds or gouge it out of the ground with the walking legs of one side, like a fiddler. Dirt while being carried from a burrow is hugged against the body by either chela and the walking leg next to it or held in both chelae, like a washerwoman carrying an armful of clothes. Burrows were closed by pushing up soft mud from the inside, thus shutting the owner in.

The holes were often dug at the bases of trees or under stumps, but many were scattered over the open flats. They went down to water or soft mud.

Cardisomas keep themselves clean. After carrying a load they rub their chelae together and scrape themselves with the legs. The eyestalks are wiped with the maxillipeds.

In fighting the males use the great claws after the manner of fiddler crabs. Combats were often seen.

Cardisoma guanhumi is found in the Bahamas, and from Florida Keys to Brazil.

GECARCINUS LATERALIS (Freminville).

Loose carapaces and claws were found at Punta Gruesa, but the only living specimens were seen on the ocean beach at the mouth of the Manzanares River. A male and a female were collected on the night of August 27. One of these was at the bottom of a burrow 6 inches deep on the sandy beach. Another female was taken two days later about 500 meters from the river at the edge of a rock slide in the cactus brush. This individual had established herself under a rock, where she had made a shallow excavation. The male measured 37.2 mm. long by 49.2 mm. wide; the larger female, 34.5 by 44 mm. This species ranges from the Bermudas, Bahamas, and Florida Keys to Colombia and Venezuela.

UCA MORDAX (Smith).

Common in holes in the clay flat at the mouth of the Manzanares River, where it associated with *Cardisoma guanhumi*, and at Punta Gruesa in holes in sand, under logs, and among mangrove roots. On August 29 a female carrying eggs was captured at the first locality mentioned. Thirty-five specimens were preserved. The largest male measures 12.5 by 18.8 mm.; the largest female, 10.2 by 14 mm. Range, from the Bahamas and West Indies to Rio de Janeiro.

UCA MINAX (Le Conte).

Abundant in the mangroves at Punta Gruesa. Eighteen specimens were taken. Size of largest male, 20.5 by 29.8 mm.; female, 16.1 by 22.8 mm. Range (Smith, '70), Connecticut to Florida, and (now) Colombia.

OCYPODE ALBICANS Bosc.

Common on the sandy beaches at Santa Marta and 1 mile north of Punta Gruesa; burrowing in holes along the ocean. Range, New York to Brazil.

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EXPLANATION OF PLATES.

(From photographs furnished by Mary G. Rathbun.)

PLATE 70.

Pseudothelphusa pearsei, male.

FIG. 1. Paratype (45865); right first abdominal appendage; dorsal view, × 3.
2. Same specimen; abdomen, × 3.
3. Same specimen; left outer maxilliped, × 3.
4. Holotype; dorsal view, × 1½.
5. Same specimen; front view, × 1½.

PLATE 71.

Pseudothelphusa clausa, male.

FIG. 1. Paratype (45878); left first abdominal appendage; inner view, × 3.
2. Same specimen; abdomen, × 3.
3. Same specimen; left outer maxilliped, × 3.
4. Holotype; dorsal view, × 1½.
5. Same specimen; front view, × 1½.

PLATE 72.

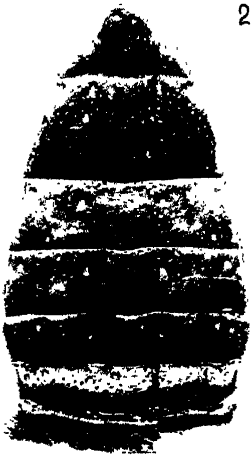
Pseudothelphusa angulata, male, holotype.

FIG. 1. Left first abdominal appendage; inner view, × 3.
2. Abdomen, × 3.
3. Left outer maxilliped, × 3.
4. Dorsal view, × 1.
5. Front view, × 1.

PLATE 73.

Pseudothelphusa ruthveni, female, holotype.

FIG. 1. Left outer maxilliped, × 3.
2. Dorsal view, × 1½.
3. Front view, × 1½.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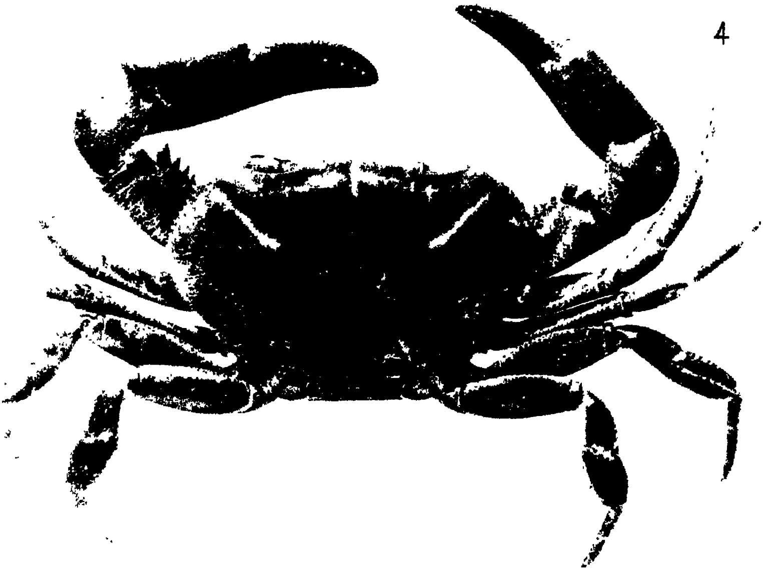
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PSEUDOTHELPHUSA PEARSEI.

FOR EXPLANATION OF PLATE SEE PAGE 556.

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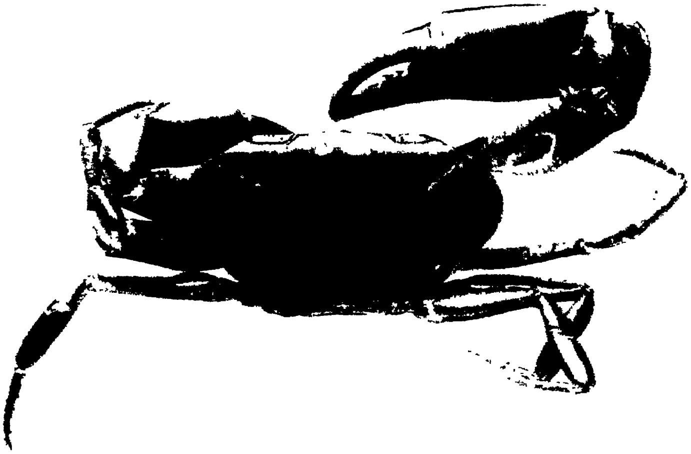

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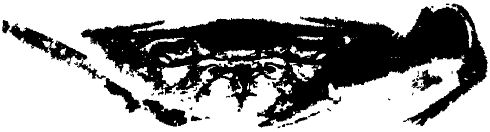

PSEUDOTHELPHUSA CLAUSA.

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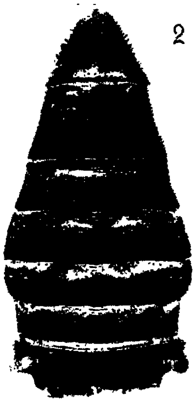

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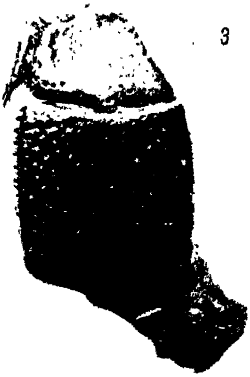

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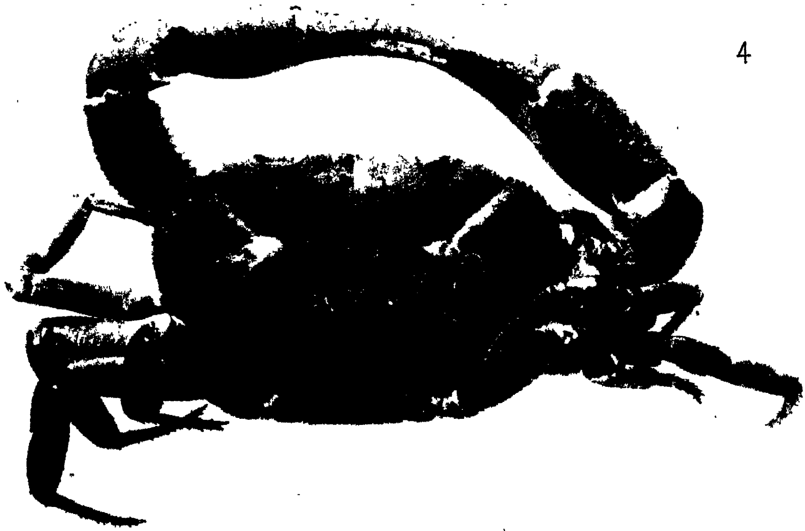

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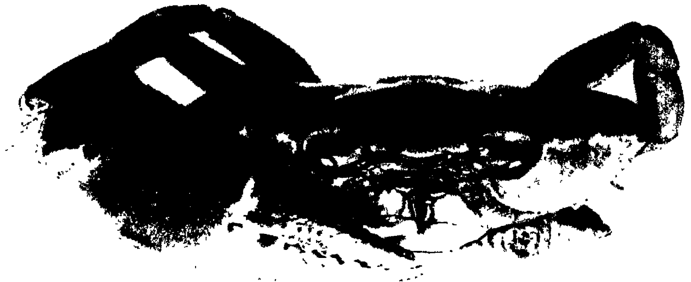

PSEUDOTHELPHUSA ANGULATA.

FOR EXPLANATION OF PLATE SEE PAGE 556.

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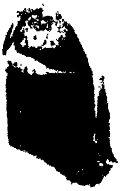

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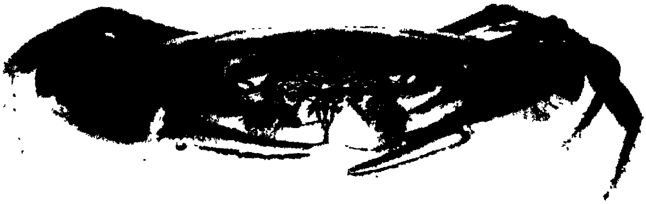

PSEUDOTHELPHUSA RUTHVENI.

FOR EXPLANATION OF PLATE SEE PAGE 556.

NOTES ON THE SPECIES OF THE MOLLUSCAN SUBGENUS NUCELLA INHABITING THE NORTHWEST COAST OF AMERICA AND ADJACENT REGIONS.

By William Healey Dall.

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The species of *Nucella* Bolten, more familiarly known as *Purpura* but not the *Purpura* of the classical writers nor of Martyn in 1784, are so far as known confined to the Northern Hemisphere, and flourish especially in its cooler waters, some species extending their range nearly to the Arctic Circle. The type of the subgenus is the solitary North Atlantic species *N. lapillus* of Linnaeus, the genus *Thais* Bolten, covering both the northern and tropical groups. The synonymy has been exhaustively treated in another publication.[1] The history of *N. lapillus* has been worked up by the Rev. Dr. A. H. Cooke in a recent paper[2] and he included a notice of the Pacific species, the synonymy of which had been previously considered by Vanatta.[3]

The very rich series of these shells contained in the United States National Museum and the doubts expressed as to the relations of several of the nominal species suggested that a review of the North Pacific forms might properly supplement Doctor Cooke's admirable paper on the Atlantic species.

The nucleus of the northern species of *Nucella* is smooth, white, slightly gibbous, with an apical dimple and one and a half whorls. No essential variation from this type has been noted in any of the species. In adults it has generally been lost through attrition. The extreme tip is bulbous and relatively large. The transition from the nuclear to the adolescent stage is abrupt, the newer surfaces taking on at once, above the suture, two or three strong spiral ridges.

The nucleus of the tropical species is different. It is very difficult to obtain specimens in which it is intact, even in the very young.

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[1] U. S. Geological Survey, Professional Paper No. 59, Washington, 1909, pp. 46–51.

[2] Proceedings of the Malacozoological Society of London, vol. 11, 1915, pp. 192–209.

[3] The Nautilus, vol. 24, 1910, pp. 37–38.

In the instances when I was able to detect it the color was invariably reddish brown. Instead of the bulbous, slightly irregular nucleus noted in *Nucella*, *Thais biserialis* has a regular, somewhat dome-shaped nuclear spire, with very minute apical portion and two and a half regularly coiled smooth whorls. *Patellipurpura patula* has the nuclear spire elevated and trochiform, the apex very minute and whitish, the remainder dark reddish brown, smooth and polished; in all about four and a half whorls. *T. columellaris*, though not so well preserved, seems to have a similar nucleus. In all cases the transition between the nucleus and the adolescent sculpture is abrupt.

The sculpture in *Nucella* may be axial or spiral or both. It may be entirely obsolete over the greater part of the shell, but no matter how smooth the latter appears there are always traces of the spiral ridges which immediately follow the smooth nuclear portion, provided the apical part of the specimen is not worn.

The spiral ridges of the nepionic shell between the sutures are persistent in sculptured specimens. They increase by intercalation, and the number of major ridges is quite constant in each species; the differences arising largely from the close or lax coiling of the whorls, which may sometimes leave exposed ridges which are usually hidden under the suture. Between the major ridges there are frequently numerous minor threads which are irregular in number and strength. In rare cases one or more major ridges will split into two or more small ones, which do not materially differ from the minor threads in size or appearance, but usually the discrimination between the two classes is not difficult.

Beside the regular threads on *N. lamellosa* there are fine, almost microscopic, more or less obsolete spiral striations, which are hardly perceptible except in specimens entirely free from surface erosion.

In one variety of *N. canaliculata* the major spirals are, as it were, flattened down until the interspaces are reduced to sharply incised lines, and the shell exhibits a very marked contrast to the variety with elevated ridges and channeled interspaces which Middendorff named *decemcostata*. But there are intermediate variations.

In some mutations, while one or two major spirals persist near the periphery of the whorls, the space between them and the preceding suture will be flattened, giving a conical aspect to the whorls. In others the spiral sculpture, after the first nepionic turn or two, may have become quite obsolete, the whorls inflated, and the sutures deep, giving the shell the aspect of a *Chrysodomus*. The axial sculpture in *lamellosa* usually takes the form of elevated sharp lamellae crenulated by their intersection with the major spirals. In some cases the lamellae are low except where they cross the spirals, and in a few instances they may take the form of fine low close imbrications such as characterize the form *imbricata* of the Atlantic *N. lapillus*.

In the other northwest coast species the lamellations do not become marked; in extreme cases they convey the impression of low close imbrication, or they may be reduced to mere elevated lines or even be altogether absent.

In only one of the species, *N. emarginata,* do we find nodulation of the spirals, and this not accompanied by any axial ribbing.

The suture is simple and closely appressed in this group, though the proximity of an elevated spiral, as in *N. canaliculata* gives the shell an aspect of being channeled at the suture.

The whorls are usually of a moderate convexity modified in particular instances by the external sculpture. There is little variation in their numbers within the species; it frequently happens that the short stumpy specimens and the slender elevated ones prove on examination to have the same number of post-nuclear whorls. The variation between specimens fully adult and of the same general type rarely exceeds one whorl, and that toward the apex of the shell. In coiling there is great variation more or less correlated with environment.

The sheltered rocky beaches of a well-protected harbor will afford slender elongated and lamellose specimens with small apertures. The outer rocks exposed to the ocean surf have short-spired, relatively smooth, wide-mouthed shells, which afford the least leverage to the waves. For, washed from his perch and carried to the muddy bottom off the shore by the undertow, an adult *Nucella* can hardly survive; and those offering the least friction and having the stronger hold on their situs are most likely to survive. There is also a connection between the situs and the shell which is less easily explained, and that is that, on rough surfaces such as an "oyster reef," or bar, the specimens of *lamellosa* are almost unanimously rough and laminate, while in undisturbed water on rocks with sandy surroundings the finest and most delicate development of lamellae and crenulations is to be found, according to the reports of collectors. In all cases *Nucella* seems to prefer a rocky habitat, especially if it affords young oysters or other sessile or sluggish species serving it as food.

The siphonal fasciole in these shells is usually strong, with the callus of the pillar lip folded over the inner half of its cavity. The elevation or depression of the shell seems to have no effect on the axis of the pillar, but occasional specimens, usually old and more or less pathologic, show a decided umbilical chink. The canal in well-developed specimens is rather strongly recurved.

The aperture in all the species, when mature, is margined by a continuous callus, sometimes thin and closely appressed, but in solid and heavy specimens thick, with an elevated edge on the body and pillar. The outer lip, while hardly reflected, has a certain flare and is slightly expanded. The pillar lip is smooth and in exceptionally developed specimens of *lamellosa* there is an obscure thickening on the middle of the pillar. Well within the aperture in this species, when well developed, is a group of three (or occasionally four) teeth separated by a marked gap from the posterior sinus of the aperture, and by a less conspicuous gap from two more or less dentiform nodulations near the constriction at the proximal end of the canal. Many apparently well-developed individuals, however, show no trace of denticulation. For a long time it was supposed that *N. lamellosa* was the only west coast species developing teeth, but Miss Bertha M. Challis by careful search has found individuals of other species which also do so. As a general rule, however, it may be stated that the development of teeth in these northwest coast species is much less constant than in the North Atlantic *N. lapillus*.

The coloration of the shell varies in all the species. In most specimens of *lamellosa* it is uniform over the entire individual and ranges from pure white through various shades of yellow and yellowish brown to a very dark brown. Specimens from quiet water are frequently of a gray or greenish gray from an algal deposit which when removed shows the true color of the shell. Some specimens have a white band at or slightly below the periphery, but any breaking up of the other colored areas by additional white spiral bands is extremely rare.

This species never shows flammulation or banding of a darker or different color. The margin of the aperture is generally pale, the throat darker, brownish, or purplish brown in dark specimens; white or slightly yellowish in white specimens.

In *N. canaliculata* the range of coloration is about the same, except that when banded there are usually two white bands, one near the periphery and one on the base, and the resulting brown bands are frequently broken up into patches or flammulations by gaps of paler or whitish color. The outer lip is usually crenulated at the edge by the exterior sculpture, and the interspaces between the spirals are more or less reticulated by close-set axial elevated lines. The production of teeth in this species is rare; when present, following a posterior smooth space, there is a continuous line of eight or nine small teeth to the beginning of the canal. In *N. lima* the color characteristics are much the same as in *N. canaliculata,* though it is rarely flammulate; but, even in the heaviest and most callous adults, I have not been able to detect any trace of denticulation in the aperture.

In *N. emarginata* the most conspicuous feature, after the nodulation of the spiral bands, is (except in unicolored specimens) the presence of narrow, usually dark-brown bands between the lighter colored, usually white, major spirals. None of the other species has this feature. While the nodules are sometimes subspinose, there is never any prominent axial lamellation. The pillar is conspicuously concavely arched, and there are occasionally from three to eight obscure denticulations within the outer lip. The colors range about the same as in the other species, but there seem to be fewer light colored and more melanitic specimens. The proportion of unicolored individuals is markedly less.

The operculum throughout the group has the usual characters belonging to the genus. It seems to be rather larger, in proportion to the aperture, and perhaps generally darker in color in *N. emarginata* and smaller and paler in *N. lamellosa* than in the other two species.

Thinking that the major spirals might afford some specific characters, all the specimens in the collection were subjected to a careful count, 1,753 in all. The count was taken at the end of the penultimate whorl from the commissure of the outer lip with the body whorl to the suture behind. Only adult specimens were included in the count.

Of 529 specimens of *N. emarginata* 433 had two, 78 had only one, and 18 had three major spirals. The intercalary spiral threads in the whole space between the sutures varied from none to three, 290 specimens having none, 118 having one, 109 having two, and 12 having three.

Of 315 specimens of *N. lima* 110 had three major spirals, 130 had four, 71 had five, 2 had six, and 2 had seven. Of intercalary threads two had none, 135 had three, 114 had four, 31 had five, and 3 had six.

Of 363 specimens of *N. canaliculata* 27 had three major spirals, 135 had four, 136 had five, 63 had six, 1 had seven, and 1 had eight. Of intercalary threads, 112 had none, 6 had one, 43 had two, 57 had three, 78 had four, 56 had five, 7 had six, and 4 had seven.

Of 549 specimens of *N. lamellosa* 32 had one major spiral, 417 had two, 4 had three, and 2 had four. On the last whorl 368 had nine major spirals and the others varied from one to thirteen.

Of 21 specimens of *N. freycinetii* 18 had two major spirals and the others three. The intercalaries varied from two to five; but the number of specimens being so restricted, the result in this case is not conclusive.

If these figures for the major spirals be platted, it will be evident that the profile of the curve for each species has its own characteristics, and it is quite possible that the few scattering exceptions to the rule may be due to hybridization.

The species of *Nucella* are in the main carnivorous, and have been observed by me to feed on small bivalves like *Anomia*, on Ascidian colonies, and on the ovicapsules of their own and other species of gastropods. In scraping off other small invertebrates from kelp and rockweeds it is probable they swallow a certain amount of vegetable matter, and on one occasion I found several feeding on the rather putrid body of a dead fish. Yet I have never observed them attacking other mollusks in which the shell had attained a certain degree of solidity, and conclude that they confine their predatory work to animals and substances only moderately well protected from such attacks.

These animals prefer a rocky habitat, especially one well covered with fucus, underneath which they remain concealed, and they are rarely seen exposed to the glare of the sun. They occur from the vicinity of high-water mark to a depth of several feet below low water, and have been dredged from a considerably greater depth, in one case in over 60 fathoms. But these specimens are usually not living, and their presence at such a depth can be ascribed to accident, such as the disgorging of a recently swallowed shell by a fish, or washing from their actual situs by the surf. Some species, like *N. lamellosa*, appear to frequent banks of rock or coarse gravel which are rarely uncovered by the tide and yet are favorite haunts of barnacles, and of oysters, anomias, and other rough bivalves upon whose young the *Nucella* feeds. The smaller species, like *emarginata*, seem to prefer the rocks covered with bladder-weed along shore.

I have not observed *Nucella* among the shells in the aboriginal middens of the Alaskan coast, nor are they eaten by the natives at the present time, although abundant enough to form an article of food. Jeffreys states that the British species is found in some of the Pictish middens, and that it is destructive to mussels and limpets, but on the Alaskan coast during many years collecting I have never found a drilled limpet shell or a *Nucella* attacking any but very young mussels.

The ovicapsules are abundant in early spring and, like those of the tribe elsewhere, are elongate slender yellowish vaselike objects of a parchmentlike texture, with a flat circular top, and are mounted on slender cylindrical peduncles in groups on rocks or dead bivalves.

The young, of which a considerable number occur in a single capsule, are cannibals, the weaker ones being devoured by their brethren while still in the capsule, from which the survivors emerge at the top, leaving the vase unsealed. The adults also browse on the capsules, which are easily cut through by the sharp teeth of the radula.

Like the other species, these produce a purple dye, which I tested on an old handkerchief. It gave a dull purple color, which faded badly; but I afterwards learned that it could be made permanent by the addition of lemon juice, which is used with the purple of the tropical species by the natives of Central America and Peru. However, I have never seen any articles dyed with this substance which had any brilliancy or attractiveness of tint. If the classical descriptions of the Tyrian dye are correct, the American purple can not compete with it.

Jeffreys says that the fluid contained in the *N. lapillus* ovicapsules is also purpuriferous (besides having a disagreeable peppery taste), and I have noticed in Alaska that the brownish-yellow groups of capsules sometimes have a purplish tinge. In the animals themselves the secretion bears no comparison in amount or color with that afforded by the tropical species, especially *Patellipurpura*.

THAIS (NUCELLA) LAMELLOSA Gmelin.

Plate 74, figs. 5–8.

Buccinum plicatum MARTYN, Univ. Conch., 1784, fig. 44; not of Linnaeus, Syst. Nat., ed. 10, 1758, p. 735.

Buccinum compositum CHEMNITZ, Conch. Cab., vol. 10, 1788, p. 179, vign. 21, figs. *a*, *b* (nomenclature not Linnean).

Buccinum crispatum CHEMNITZ, Conch. Cab., vol. 11, 1795, pp. 70, 84, pl. 187, fig. 1802–1803, (nomenclature not Linnean).—DILLWYN, Recent Shells, vol. 2, 1817, p. 613; not of Solander in Dillwyn, vol. 2, p. 707.

Buccinum lamellosum GMELIN, Syst. Nat., vol. 7, 1792, p. 3498.—DILLWYN, Recent Shells, vol. 2, 1817, p. 612.

Buccinum lamellosum BOLTEN, Mus. Bolt., ed. 1, 1798, p. 113, Nos. 1462–1463 (23); ed. 2, 1819, p. 80, Nos. 1435–1436 (23), pl. 1, fig. 4.

Polyplex rugosus PERRY, Conch., 1811, pl. 9, fig. 2.

Murex crispatus LAMARCK, Anim. s. Vert., vol. 7, 1822, p. 174; Encycl. Meth., 1816, pl. 492, fig. 2; Deshayes' Lamarck, Anim. sans Vert., vol. 9, 1845, p. 576.

Murex ferrugineus ESCHSCHOLTZ, Zool. Atlas, pt. 1, 1829, p. 10, pl. 9, figs. 2 *A–B*.

Murex lactuca ESCHSCHOLTZ, Zool. Atlas, pt. 1, 1829, p. 11, pl. 9, figs. 3 *A–B;* not of Bolten, Mus. Bolt., 1798, p. 141, as *Purpura* (=*Murex saxatilis* Linnaeus, Syst. Nat., ed. 10, 1758, p. 747; +*Purpura saxatilis* Meuschen, 1787).

Polytropa crispata SWAINSON, Malac., 1840, p. 305.

Purpura septentrionalis REEVE, Conch. Icon., vol. 3, 1846, *Purpura*, pl. 10, fig. 50.—MIDDENDORFF, Beitr. Mal. Ross., vol. 2, 1849, p. 117.

Murex lactuca MIDDENDORFF, Beitr. Mal. Ross., vol. 2, 1849, p. 120, pl. 7, figs. 1, 2.—FISCHER in Pinart, Voy. Côte N. W. de l'Amer., 1875, p. 38, pl. E, figs. 4, 4*a*.

Purpura crispata CARPENTER, Rep. Brit. Assoc. for 1863, p. 662, 1864 (Smithsonian reprint 1872, p. 148).—ARNOLD, Pal. San Pedro, 1903, p. 261.

Purpura plicata MARTENS, Mal. Blätt., vol. 19, 1872, p. 86.

Purpura lapillus var. *crispata* TRYON, Man., vol. 2, 1880, pp. 171–229, pl. 54, figs. 163–166.

Thais (*Nucella*) *lamellosa* DALL, Prof. Paper, No. 59, U. S. Geol. Survey, 1909, p. 80.

Thais plicata VANATTA, Nautilus, vol. 24, No. 4, 1910, p. 37.—COOKE, Proc. Mal. Soc., vol. 11, pt. 4, 1915, p. 203.

? *Purpura lapillus* var. *quillayutea* REAGAN, Trans. Kansas Acad. Sci., vol. 22, Geol. ser., 1909, p. 221, pl. 6, figs. *a–b*.

Range.—Bering Strait at Port Clarence; south on the west to the Japan Sea off Sado Island in 161 fathoms (dead); on the east to the Aleutian Islands and to Cook's Inlet, Oregon, and Santa Barbara, California. Pleistocene of California and Oregon. Pliocene of San Diego and San Mateo Counties, California, and Clallam County, Washington.

This species submits to such changes, incident to situs, that single specimens, or even numerous specimens from single localities, might well be taken for different species, especially as specimens from a single locality often exhibit a singular uniformity of characters, even in factors which would seem not likely to be subject to influences of the environment, such as the number of the major spirals. These uniformities are probably due to inheritance from common ancestors. The only way to get a broad view of the range of characters is to have not only many specimens but specimens from many localities. Then the gradations can be recognized in a way not otherwise possible.

There are some of these forms which exhibit characteristics of a uniformity which entitles them to be called varieties, irrespective of the differences due to color-variation, and other mutations.

THAIS LAMELLOSA Gmelin, typical form.

Type locality (to which it is by no means confined) Nootka Sound, Vancouver Island.

Shell large, heavy, with a conic spire shorter than the aperture in most specimens, prominently laminated with from 9 to 20 sharp-edged elevated lamellae, crenulated and produced where they intersect a major spiral; on the penultimate whorl there are two, on the last whorl seven to nine major and an indeterminate number of minor spirals, the former most prominent near the shoulder of the whorl, diminishing in size and more adjacent progressively toward the canal; aperture large, the outer lip flaring, the throat sometimes dentate, the umbilical chink usually sealed by callus (63873).

In the following measurements in millimeters the nucleus is not included:

Measurements.

TYPICAL FORM.

Whorls.	Height of shell.	Height of last whorl.	Breadth.
6	72	54	38
6	81	65	46
7	86	57	42

LAMINATE FORM.

Whorls.	Height of shell.	Height of last whorl.	Breadth.
4	40	35	26
4½	38	34	27
5	39	32	28.5

SMOOTH FORM (60125).

4	46	41	32
4½	48	42	30
4½	30	31	24

THAIS LAMELLOSA, new variety FRANCISCANA.

San Francisco Bay.

Shell subfusiform, heavy, with a subconic spire shorter than the aperture, laminae reduced to obsolete low imbrications or usually none; whorls flattened behind the shoulder; major spirals low, feeble, two on the penultimate whorl, seven or more on the last whorl, minor spirals obsolete or none; aperture large, the outer lip flaring, umbilical chink usually distinct but closed (63909).

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Breadth.
4½	50	40	28
4½	52	41	29
5	51	42	29

THAIS LAMELLOSA, new variety HORMICA.

Inner part of Sitka Harbor, Alaska.

Shell of smaller size than either of the preceding, thin, with spire subacute, produced, longer than the aperture; whorls angular with more or less prominent axial laminae, 10 or more to the last whorl, often produced at the angles into guttered spines; major spirals two on the penultimate, five or six on the last whorl; aperture small, the outer lip hardly expanded, only moderately callous; the umbilical chink usually obsolete (88862).

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Breadth.
6	48	30	21
6	53	34	25
6½	48	32	20

THAIS LAMELLOSA, new variety NEPTUNEA.

Cook Inlet.

Shell large, heavy, smooth, with rounded whorls and deep though appressed sutures, resembling a very thick and heavy *Chrysodomus*.

The measurements are about the same as in the typical form.

THAIS LAMELLOSA, new variety CYMICA.

Typical locality: Rocks exposed to the surf, coast of Washington.

Shell short, robust, heavy, very thick, spire short-conic, shorter than the aperture, one mutation being sparsely laminate, the other with a smooth surface; whorls flattened behind the shoulder; major spirals obsolete or none; when present, there is one on the penultimate whorl and five or six on the last whorl; aperture large, outer lip flaring, umbilical chink usually concealed by the callus.

THAIS LAMELLOSA, new variety SITKANA.

Inner harbor of Sitka, Alaska.

Shell resembling var. *hormica*, but smaller and thinner, the spire produced, subacute, longer than the aperture; whorls rounded, with no lamination; major spirals conspicuous, two on the penultimate, five or six on the last whorl; aperture small, outer lip not reflected, usually with a deep umbilical chink.

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Breadth.
4½	36	24	17
4⅓	36	24	17
5	38	25	18

If names were given to mutations such as color markings, etc., the number might be indefinitely increased. All the varieties seem to run through the same gamut of color, and to have banded mutations. I have not been able to satisfy myself as to the existence of differences in the shell due to sex, but the subject requires further study.

THAIS (NUCELLA) LIMA Martyn.

Plate 75, figs. 4–6.

Buccinum lima MARTYN, Univ. Conch., vol. 2, 1784, pl. 46.

Purpura saxicola VALENCIENNES, Voy. *Venus*, Atlas, 1846, p. 4, pl. 8, figs. 4, 4*a*.

Purpura attenuata REEVE, Conch. Icon., vol. 3, September, 1846, *Purpura*, pl. 10, fig. 49.

Purpura freycinetii (part), MIDDENDORFF, Sib. Reise, vol. 2, 1851, p. 219, pl. 12, figs. 5–9 (not of Deshayes, 1839); also in Beitr. Mal. Ross, 1849, p. 117.

Purpura canaliculata et saxicola (part), CARPENTER, Rep. Brit. Assoc., for 1863, p. 662, 1864. (Smithsonian reprint, 1872, p. 148.)

Purpura lapillus var. TRYON, Man., vol. 2, 1880, p. 175; not of Linnaeus.

Purpura lima (part), TAYLOR, Trans. Roy. Soc. of Canada, ser. 2, sect. 4, 1895, p. 72.

Thais lima VANATTA (syn. excl.) Nautilus, vol. 24, August, 1910, p. 37.—KEEP, W. Coast Shells, 1911, p. 180, fig. 169.

Purpura lima COOKE (syn. excl.) Proc. Mal. Soc. London, vol. 11, pt. 4, 1915, p. 203.

Range.—From Kotzebue Sound, Arctic Ocean, south to Bering Strait and on the west to Bering Island, Kamchatka, the Kuriles and Japan. On the east to the Aleutian Islands, southeastern Alaska to California at Monterey, San Pedro Point, San Diego, and off Lower California on Cerros Island.

Shell of three and a half to four rounded whorls, not including the nucleus; moderately thick with a spire much shorter than the aperture, the last whorl much the largest; with a tolerably uniform spiral sculpture of alternated major and minor spiral cords; aperture large, outer lip not reflected and seldom thickened, more or less crenulated, by the sculpture; pillar slightly arcuate, flattened anteriorly, the canal narrow and curved to the left; umbilicus sometimes sealed, at others showing a deep narrow perforation behind the callus of the reflected pillar.

Type locality, Nootka Sound.

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Breadth.
3½	43	40	30
3½	50	45	30
3½	60	54	36

THAIS (NUCELLA) CANALICULATA Duclos.

Plate 74, figs. 1–4.

Purpura canaliculata DUCLOS, Ann. Sci. Nat., vol. 26, Mai, 1832, p. 104, pl. 1, fig.1 , California.—HUMBOLDT and BONPLAND, Recueil d'obs. de Zool., vol. 2, 1832, p. 316.

Purpura analoga FORBES, Proc. Zool. Soc. London, 1850, p. 273, pl. 11, fig. 12, California.

Purpura decemcostata MIDDENDORFF, Beitr. Mal. Rossica, vol. 2, 1849, p. 116, pl. 9, figs. 1–3.

Purpura lapillus var. *beringiana* MIDDENDORFF, Sib. Reise, vol. 2, 1851, pt. 1, p. 222, pl. 12, figs. 10, 11 (only), Okhotsk Sea.

Purpura freycinetii MIDDENDORFF, (part) Beitr. Mal. Ross., 1849, p. 117.

Purpura canaliculata CARPENTER, Rep. Brit. Assoc., for 1863, p. 662, 1864 (Smithsonian reprint, 1872, p. 148), (syn. ex. parte excl.); Puget Sound to San Francisco, California.

Purpura lapillus var. TRYON, Man., vol. 2, 1880, p. 175, pl. 53, fig. 156.

Purpura lima, (part), TAYLOR, Trans. Roy. Soc. Canada, ser. 2, vol. 1, sect. 4. 1895, p. 72, not of Martyn, 1784.—VANATTA, Nautilus, vol. 24, No. 4, August, 1910, p. 37.—KEEP, W. Coast Shells, 1911, p. 180, fig. 169.—COOKE, Proc. Mal. Soc. London, vol. 11, pt. 4, March, 1915, p. 203.

Range.—Aleutian chain from Attu eastward to Sitka and southward to Puget Sound and Monterey, California.

This species has been confounded with *Thais lima* by several authors and with *T. freycinetii* by others. Tryon, as usual, "lumps it" with *T. lapillus*. The reasons for considering it distinct will follow later.

At the same time that this species was described by Forbes under the name of *analoga* another species was named *fuscata*, figured, and said to come from the Hawaiian Islands. Carpenter in his report of 1864 says the types of *fuscata* in the British Museum comprise one brown and one immature white specimen, which he describes as a "large smooth rather elevated variety of *saxicola*" (p. 592). This does not at all agree with Forbes's figure. On the other hand, Cooke (p. 204) states that "The type of *fuscata* is the larger of two specimens in the British Museum, collected by Captain Kellett and

Lieutenant Wood, R. N. * * * The spire is elevated and the spiral ridges well marked." This is probably correct; at any rate, the observations on the species here made are based on the supposed accuracy of the figure in the Proceedings of the Zoological Society.

The figure is excellent and portrays a shell with two strong spiral ribs on the penultimate whorl separated by deep axially threaded channels. On the last whorl there are six of these ribs. The aperture is about one-fifth longer than the spire. No species with these characters is known from the northwest coast. The Hawaiian Islands have long been known for the great number of shells from all parts of the Pacific brought there by whalers and traders, many of which in the literature have erroneously been supposed to form part of the fauna of the Hawaiian group. The figure of the *Purpura fuscata* of Forbes agrees almost exactly with the Indo-Pacific species named by Velain *P. dumasi* variety *cincta*,[1] and I have a suspicion it is either that or a closely related Indo-Pacific species.

THAIS CANALICULATA, typical form.

Type locality, "California."

Shell bucciniform, of three and a half to four rounded whorls exclusive of the nucleus, moderately thick, with a spire about one-half shorter than the aperture, the last whorl largest, with a very uniform sculpture of strong elevated spiral ridges separated by distinctly channeled interspaces crossed by small slightly elevated axial lamellae or elevated lines; minor spirals very rarely occur; there are 4 to 6 major spirals on the penultimate whorl and about 10 on the last whorl; outer lip not reflected and only slightly thickened, usually crenulated by the external sculpture; pillar moderately arcuate, flattened in front where the callus conceals but does not seal a long narrow umbilical chink; canal narrow, recurved (220973).

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Height of aperture.	Breadth.
3½	34	27	20	18
4	40	30	21	20
4	41	33	23	23

THAIS CANALICULATA, var. ANALOGA Forbes.

"California."

Similar to the preceding but stouter, usually with one more whorl, and with a minor spiral regularly intercalated between the major spirals.

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[1] Arch. Zool. Exper., vol. 6, 1876, p. 102, pl. 2, fig. 15.

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Height of aperture.	Breadth.
4½	43	36.0	28.0	27
4½	46	36.5	25.0	25
4½	47	37.0	27.5	27

THAIS CANALICULATA, new variety COMPRESSA.

Monterey, California (60102).

Shell similar to the typical form but with the elevated ridges or major spirals flattened down until the interspaces become almost linear. There are 6 or 7 on the penultimate whorl and 12 or 13 on the last whorl.

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Height of aperture.	Breadth.
3½	36	30	24	21.5
3½	38	34	25	23.0
4	34	29	23	22.0

THAIS (NUCELLA) EMARGINATA Deshayes.

Plate 75, figs. 1–3.

? *Purpura lagenaria* DUCLOS, Ann. Sci. Nat., vol. 26, Mai, 1832, p. 112, pl. 2, fig. 11; not of Lamarck, 1822.

? *Purpura rupestris* VALENCIENNES, Voy. *Venus*, Atlas, 1846, pl. 9, fig. 1, *a–b*, (Magnified figure.)

Purpura emarginata DESHAYES, Rev. Zool. Soc. Cuv., 1839, p. 360; Mag. de Zool. (Guerin), 1841, pl. 25. (Pathologic.)

Purpura lapillus var. *anomala* MIDDENDORFF, Beitr. Mal. Ross., vol. 2, 1849, p. 115, pl. 9, figs. 4, 5 (only).

Purpura emarginata REEVE, Conch. Icon., vol. 3, *Purpura*, 1846, pl. 10, fig. 46.—COOKE, Proc. Mal. Soc. London, vol. 11, 1915, p. 203.

Purpura conradi (Nuttall MS.) REEVE, Conch. Icon., vol. 3, 1846, in synonymy.

Purpura saxicola var. CARPENTER, Rep. Brit. Assoc., for 1863, p. 662, 1864 (Smithsonian reprint, 1872, p. 148). Not of Valenciennes.

Purpura ostrina GOULD, U. S. Expl. Exped., Mollusca, 1852, p. 244; Atlas, 1857, pl. 18, figs. 310 *a*, *b*. Oregon.

Purpura saxicola TAYLOR, Trans. Roy. Soc. Canada, ser. 2, vol. 1, sect. 4, 1895, p. 72. Not of Valenciennes.

Thais emarginata VANATTA, Nautilus, vol. 24, No. 4, 1910, p. 37 (syn. exclus.).

Thais saxicola KEEP, West Coast Shells, 1911, p. 179, fig. 168.

Range.—Bering Island and the Okhotsk Sea on the west. On the east Hagemeister Island and Bering Sea south of the winter floe-line, and southeastward to California; Cerros Island, Lower California; Mazatlan and Topolobampo, Mexico.

The first two figures named in the above synonymy have a remarkable likeness to some smooth varieties of the present species. Tryon refers the first to *P. scobina* Quoy, from New Zealand and the Cape of Good Hope, but some of his other combinations are not so happy that they lead to much reliance on his opinion in this case.

The name *emarginata* is founded on a pathological feature of the type specimen, yet it is not obnoxious enough to make it necessary to reject it solely on that account. How Carpenter came to identify this species with *saxicola* of Valenciennes is a puzzle; the original figure of the latter is clearly a form of *Thais lima*, exactly duplicated by many specimens from the Northwest in our collection. The reference of *saxicola* to *T. freycinetii* is more reasonable, as the relations between that species and *T. lima* are very close, if indeed *freycinetii* is more than a subspecies of *T. lima*.

The original locality, as for many west coast shells, is given as "New Zealand." As this is erroneous, I name San Miguel Island, California, where the typical form is abundant, as the type locality.

THAIS EMARGINATA, typical form.

Shell thick, solid, rotund, with a short spire of about three whorls without the nucleus, the body rude, with coarse nodulous or subspinose major spirals, a more or less flaring thickened outer lip, a very arcuate flattened pillar, short and hardly recurved canal, and sealed umbilical concavity (220975).

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Height of aperture.	Breadth.
3	30	28	23	23
3	31	29	22	22
3½	32	28	21	20
3	34	30	23	23

THAIS EMARGINATA, var. OSTRINA Gould.

Tillamook, Oregon.

Shell thinner than the preceding, nearly smooth, the major spirals represented by interrupted bands of dark-brown color but not raised above the general surface, and generally with a more elevated spire (32176).

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Height of aperture.	Breadth.
3½	27	24	19	16
3½	27	25	20	17
3½	36	31	26	23

THAIS EMARGINATA, new variety PROJECTA.

Sitka, Alaska.

Shell thinner, more elongate and with a pointed spire, the major and minor spirals more nearly equal, two strong spirals on the earlier whorls and the sutures more constricted. This is the more northern form (88842).

Measurements.

Whorls.	Height of shell.	Height of last whorl.	Height of aperture.	Breadth.
4	29	22	17.0	15.0
4½	32	24	18.5	17.0
5	31	24	19.0	16.5

THAIS (NUCELLA) FREYCINETII Deshayes.

Purpura freycinetii Deshayes, Rev. Zool. Soc. Cuv., 1839, p. 360; Mag. de Zool. (Guerin), 1841, pl. 26.

Purpura freycineti Middendorff, Beitr. Mal. Ross., 1849, p. 117 (*part*); Sibir. Reise, vol. 2, pt. 1, 1851, p. 219, pl. 12, figs. 1–9.

Purpura freycinetii Reeve, Conch. Icon., vol. 3, *Purpura*, September, 1846, pl. 10, fig. 51.—Schrenck, Amurland Moll., 1867, p. 388.

Polytropa lapillus A. Adams, Ann. Mag. Nat. Hist., vol. 5, 1870, p. 423, not of Linnaeus.

Purpura freycinetii Lischke, Jap. Meeres Conch., vol. 2, 1871, p. 40, pl. 4, figs. 15–19.

Purpura lapillus Dunker, Ind. Moll. Mar. Japan, 1882, p. 4, not of Linnaeus.—Pilsbry (following Adams), Cat. Mus. Moll. of Japan, 1895, p. 45.

Purpura freycinetii var. *alabaster* Pilsbry, Proc. Acad. Nat. Sci. Phila., for 1907, p. 246, pl. 20, fig. 2. Chishima, Japan.

Range.—Southern Kamchatka, the Kuril Islands, the south and west coasts of the Okhotsk Sea, Sakhalin Island and Northern Japan to Kushiro.

The shell described and figured by Deshayes is immature, the complete outer lip and labial callus are not yet formed. It is further exceptional in its feeble spiral sculpture and extremely low spire. However, the peculiarities of the pillar lip and the general form enable one to connect it with the common Japanese species with a reasonable degree of probability. Since the species goes through practically the same phases of variation as *T. lima,* and both are present over part of their range, more or less confusion has resulted in the literature either from a superficial examination or a paucity of material.

The variety *alabaster* has a certain analogy with the shorter heavy forms of *T. lamellosa,* other mutations recall *T. lima,* but the most common type of all among the specimens I have been able to bring together most resembles the rougher type of *T. emarginata.* If these all belong to one species, the process of divergent evolution is less complete in Japan than in America.

EXPLANATION OF PLATES.

PLATE 74.

FIG. 1. *Thais* (*Nucella*) *canaliculata* Duclos, variety *analoga* Forbes, unusually swollen and depressed form, from Lituya Bay, Alaska. Cat. No. 220974, U.S.N.M. Alt. 31 mm., p. 568.

2. *Thais* (*Nucella*) *canaliculata* Duclos, variety *compressa* Dall, from Monterey, California. Cat. No. 60102, U.S.N.M. Alt. 38 mm., p. 569.

3. *Thais* (*Nucella*) *canaliculata* Duclos, typical form (+*decemcostata* Middendorff) Unalashka, Alaska. Cat. No. 220973, U.S.N.M. Alt. 38 mm., p. 567.

4. *Thais* (*Nucella*) *canaliculata* Duclos, mutation with obsolete sculpture from Sitka, Alaska. Cat. No 32197, U.S.N.M. Alt. 33 mm., p. 567.

5. *Thais* (*Nucella*) *lamellosa* Gmelin, variety *cymica* (smooth mutation) from Port Ludlow, Washington. Cat. No. 60125, U.S.N.M. Alt. 38 mm., p. 565.

6. *Thais* (*Nucella*) *lamellosa* Gmelin, variety *franciscana* Dall, from San Francisco Bay. Cat. No. 63909, U.S.N.M. Alt. 50 mm., p. 565.

7. *Thais* (*Nucella*) *lamellosa* Gmelin, typical form, from oyster reefs, Vancouver Island. Cat. No. 63873, U.S.N.M. Alt. 67 mm., p. 563.

8. *Thais* (*Nucella*) *lamellosa* Gmelin, variety *hormica* Dall, from inner harbor of Sitka, Alaska. Cat. No. 88862, U.S.N.M. Alt. 53 mm., p. 565.

PLATE 75.

FIG. 1. *Thais* (*Nucella*) *emarginata* Duclos, variety *ostrina* Gould, from Monterey, California. Cat. No. 32176, U.S.N.M. Alt. 36 mm., p. 570.

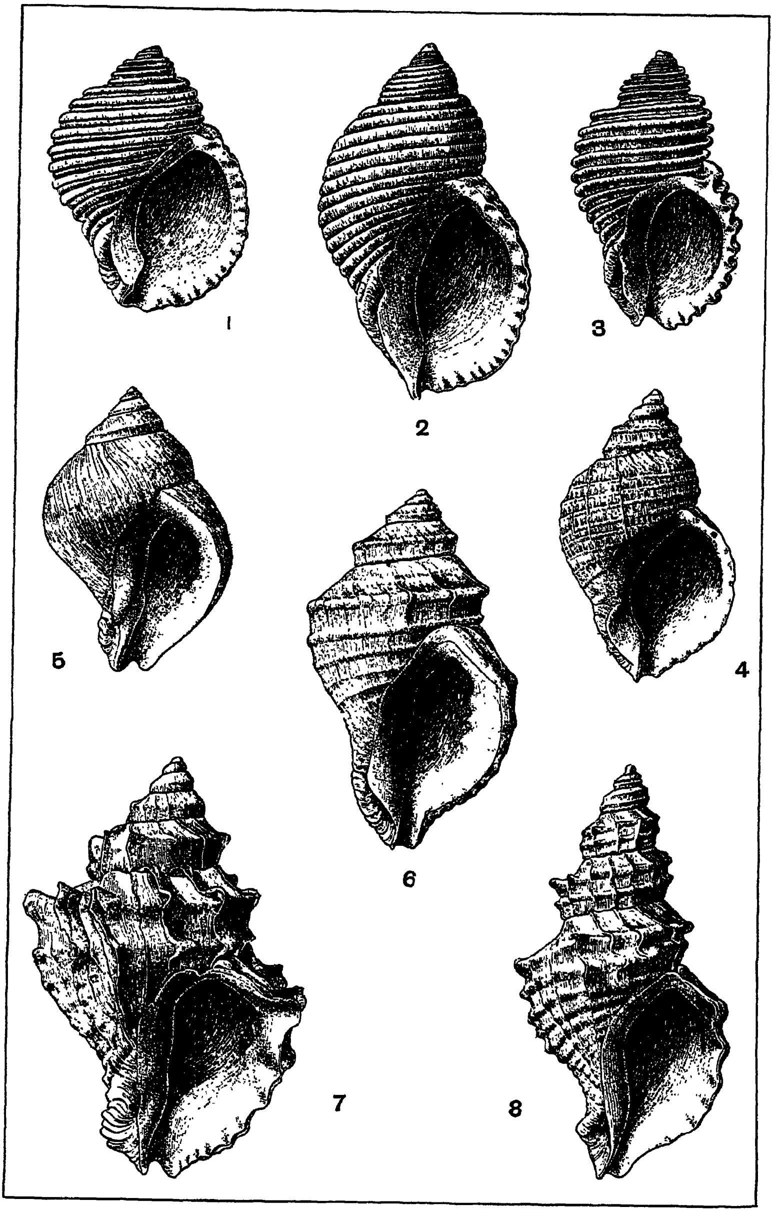
2. *Thais* (*Nucella*) *emarginata*, typical short and stout form, from Lituya Bay, Alaska. Cat. No. 220975, U.S.N.M. Alt. 30 mm., p. 569.

3. *Thais* (*Nucella*) *emarginata*, elevated form, from Monterey, California. Cat. No. 32179, U.S.N.M. Alt. 33 mm., p. 569.

4. *Thais* (*Nucella*) *lima* Martyn, typical form, smooth mutation, from Kadiak Island, Alaska. Cat. No. 60105, U.S.N.M. Alt. 33 mm., p. 566.

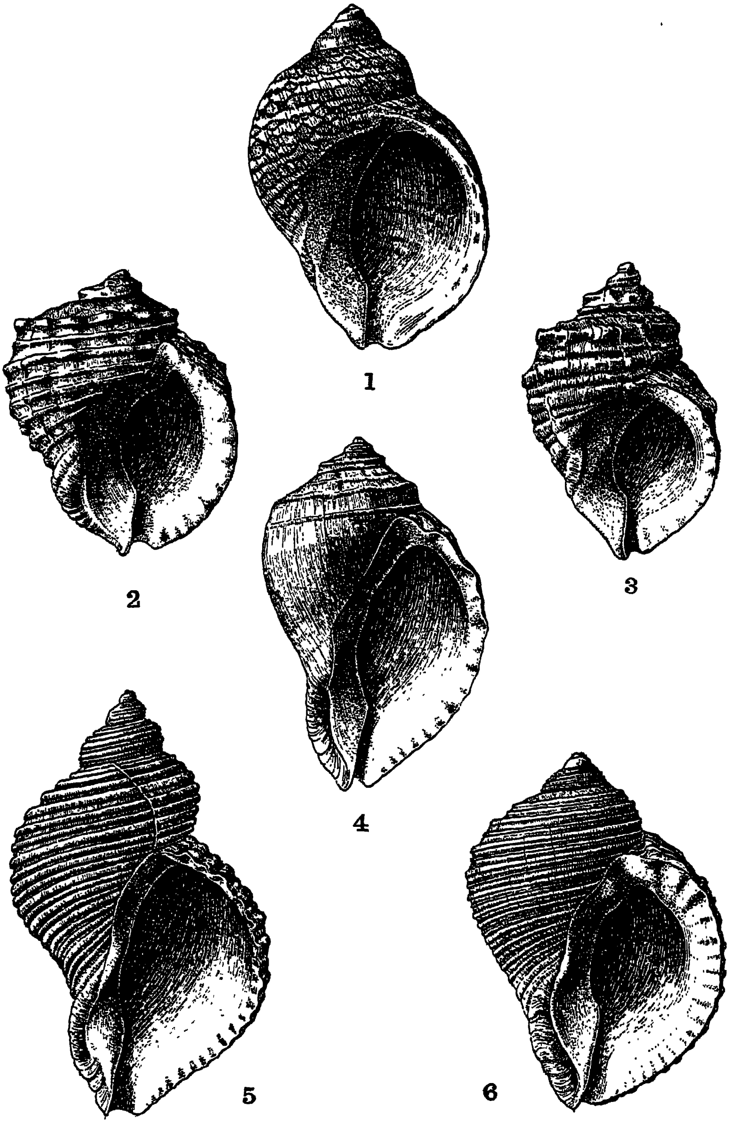
5. *Thais* (*Nucella*) *lima*, abnormally elevated mutation, from Unalaska, Alaska. Cat. No. 60084, U.S.N.M. Alt. 49 mm., p. 566.

6. *Thais* (*Nucella*) *lima*, normal form, heavy mutation, from Port Möller, Alaska. Cat. No. 220976, U.S.N.M. Alt. 40 mm., p. 566.



THAIS (NUCELLA) CANALICULATA AND THAIS (N.) LAMELLOSA.

FOR EXPLANATION OF PLATE SEE PAGE 572.



THAIS (NUCELLA) EMARGINATA AND THAIS (N.) LIMA.

FOR EXPLANATION OF PLATE SEE PAGE 572.

NOTES ON A COLLECTION OF FISHES MADE BY DR. EDGAR A. MEARNS FROM RIVERS TRIBUTARY TO THE GULF OF CALIFORNIA.

By John Otterbein Snyder.
Of Stanford University, California.

While in charge of the biological section of the survey of the Mexican boundary of the United States, from January, 1892, till September, 1894, Dr. Edgar A. Mearns, major and surgeon, United States Army, made a collection of fishes from the various streams encountered along the route. Those secured from the Gulf of California drainage are of particular interest, for although considerable has been written on the fishes of the region,[1] there are yet many questions regarding their habits, relationships, and distribution which are open to investigation.

The collection made by Doctor Mearns contains specimens from the Colorado River and some of its tributaries, from the headwaters of the Yaqui near the international boundary, and also from the Altar and Sonoyta Rivers, each of which runs an independent course to the Gulf of California. The following list will indicate the relationships of the streams examined:

- Colorado River.
  - Gila River.
    - Verde River.
      - Oak Creek.
      - Beaver Creek.
    - Santa Cruz River.
    - San Pedro River.
- Sonoyta River.
- Altar River.
  - Bear Creek.
- Yaqui River.
  - Bavispe River.
  - San Bernardino River.
  - Cajon Bonito Creek.

The faunas of the Sonoyta, Altar, and Yaqui Rivers are not yet well enough known to justify any very definite statements as to their relationships. It appears, however, that the fishes of the Yaqui have been largely derived from the Rio Grande. It also seems safe to infer that the barrier of salt water which now separates the Colorado and Yaqui Rivers has been continuous with the existence of the latter, thus preventing the Colorado fauna from extending

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[1] Evermann and Rutter; Bull. U. S. Fish Comm., No. 14, 1894, pp. 473–486. Gilbert and Scofield; Proc. U. S. Nat. Mus., vol. 20, 1898, pp. 487–499. Meek, Seth Eugene; Field Columb. Mus. Publ. 93, zool. ser., vol. 5, Rio Yaqui System, p. XXXVIII. Ellis, Max M.; Univ. of Colorado Studies, vol. 11, No. 1, 1914.

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to the Yaqui through a channel connection. At least two Colorado forms have succeeded in reaching the larger streams of southern California, where they are now represented by *Notolepidomyzon santaanæ* and *Richardsonius orcutti.*

One species, *Notropis mearnsi* is described as new.

Quotations are made from the field notes of Doctor Mearns.

CATOSTOMUS INSIGNIS Baird and Girard.

The species described by Kirsch[1] as *Catostomus gila* is synonymous with *C. insignis*, no differences appearing when the types of both are compared. On carefully reading Kirsch's paper it appears probable that his collection included three specimens of *C. insignis*, which he described as *C. gila*, and two examples of *Notolepidomyzon clarki* with

> scales on the sides of moderate size, larger anteriorly than posteriorly * * *; the anterior scales are of circular outline * * * those of the back vary large.

One of the latter he lists as *C. insignis*, and the other as *C. clarki.*

There are four cotypes of *C. insignis* in the United States National Museum. They have from 54 to 58 scales in the lateral series, 11 or 12 between the lateral line and middle of back, 9 or 10 between the lateral line and base of ventral, 26 to 30 between occiput and dorsal fin. There are 11 or 12 dorsal rays. In a cotype of *C. gila* the scales are as follows: 56, 12, 11, 30.

The following notes on the scales are taken from specimens collected by Doctor Mearns:

Scales in lateral series	54	55	56	57	58	59	60	61	62
Number of specimens	1	1	6	6	2	0	2	2	2
Scales above lateral line	11	12	13	14	..	..	..	..	..
Number of specimens	1	8	11	2	..	..	..	..	..
Scales below lateral line	10	11	12	..	..	..	..	..	..
Number of specimens	10	10	2	..	..	..	..	..	..
Scales before dorsal	26	27	28	29	30	31	..	..	..
Number of specimens	3	2	6	3	3	5	..	..	..

Proportional measurements follow:

	Cotypes of *C. insignis.*			*C. insignis* Verde R., Arizona.					
Length of body.........mm..	187	125	113	181	180	162	134	138	185
Length head	0.27	0.28	0.27	0.245	0.255	0.26	0.27	0.255	0.26
Depth body	.21	.24	.25	.25	.23	.235	.23	.25	.25
Depth caudal peduncle	.105	.11	.10	.11	.10	.10	.11	.11	.11
Length caudal peduncle	.16	.17	.155	.165	.155	.155	.15	.16	.15
Length snout	.13	.13	.13	.10	.115	.115	.12	.12	.12
Diameter eye	.05	.05	.052	.05	.05	.05	.05	.05	.05
Interorbital width	.12	.11	.11	.11	.105	.11	.11	.10	.11
Depth head	.185	.195	.195	.18	.17	.19	.18	.18	.185
Snout to occiput	.22	.23	.22	.20	.21	.22	.21	.21	.21
Snout to dorsal	.535	.53	.51	.51	.51	.53	.51	.52	.515
Snout to ventral	.595	.58	.56	.565	.575	.59	.59	.59	.58
Length base of dorsal	.15	.155	.16	.17	.155	.17	.17	.175	.175
Length base of anal	.08	.08	.075	.08	.08	.08	.08	.08	.085
Height dorsal	.17	.20	.20	.19	.19	.20	.19	.19	.20
Height anal	.195	.21	.18	.19	.20	.19	.19	.205	.20
Length pectoral	.21	.22	.19	.20	.22	.19	.19	.215	.20
Length ventral	.16	.18	.16	.165	.17	.165	.17	.18	.17
Length caudal	.235	.255	.24	.25	.245	.25	.24	.245	.255

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[1] Proc. U. S. Nat. Mus., vol. 11, 1888, p. 555.

The color of the ventral surface varies from pure white to a beautiful yellow. The upper surface is dark, the line of division between dark and light being sharply defined and located 3 to 5 scales below the lateral line.

This is a large scaled sucker with elongate head, large lips, and deep caudal peduncle. It has been reported from the lower parts of the Colorado system, its range evidently not extending up into the swift-flowing streams of the mountains.

Doctor Mearns secured specimens from the Verde and Santa Cruz Rivers and from Beaver Creek near Fort Verde.

CATOSTOMUS SONORENSIS Meek.

Some small suckers from San Bernardino Creek are identified as *C. sonorensis.* These are somewhat more slender than that described by Meek,[1] and the scales and fin rays are similar to those of *C. insignis.* No examples of the latter of similar size are available for comparison.[2]

San Bernardino Creek near the international boundary.

NOTOLEPIDOMYZON CLARKI (Baird and Girard).

A comparative study of the species usually assembled in the genus *Pantosteus* discloses the fact that they are separable into two well-defined, natural groups, one characterized by a thick cranium in which the parietals and frontals meet in a close, strong suture (fig. 1), and another by a relatively thin cranium where the parietals and frontals are separated by a long, often very narrow, fontanelle which apparently does not close even in very old individuals. For the first group the name *Notolepidomyzon*[3] is available, while *Pantosteus* must be retained for the second.

Catostomus has a broad, usually rectangular fontanelle (fig. 3), and the lips are not armed with a horny sheath as in *Notolepidomyzon* and *Pantosteus.*

Recent authors recognize three species of *Pantosteus* in the Colorado system, namely, *P. clarki* (Baird and Girard), *P. arizonae* Gilbert, and *P. delphinus* (Cope).[4]

Specimens measuring about 240 mm. from Beaver Creek near Fort Verde, are referable to *P. clarki,* as they possess the very large and somewhat rounded scales of the anterior upper parts which characterize that species. The scales in the first row above the lateral line are not much, if any, larger than those of the row immediately below. Those of the succeeding rows above the lateral line rapidly and somewhat regularly grow larger and more rounded in outline, until on the median part of the back they are much larger than any on the caudal peduncle. The lips have a prominent horny sheath. The skull is thick, the edges of the parietals and frontals uniting in a firm suture, thus completely obliterating the fontanelle.

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[1] Field Columb. Mus. Publ. 93, Zool. Ser., vol. 5, p. 32, pl. 6.

[2] The type of *Catostomus bernardini* No. 174, U.S.N.M., a specimen measuring 193 mm., has 12 rays in the dorsal, 7 in anal, 74 scales in lateral series, 15 in series between lateral line and middle of back, 12 below lateral line, and 33 between occiput and dorsal fin.

[3] Fowler, Henry W., Proc. Acad. Nat. Sci., Phila., 1913, p. 47, *Notolepidomyzon* type *arizonae.* Cope and Yarrow; Wheeler's Explor. west of the 100th merid., vol. 5, 1875 (1876), p. 673, *Pantosteus* type *platyrhynchus.* It will be noted that *Notolepidomyzon* was characterized by the size of the scales, while the type of *Pantosteus* has a large fontanelle.

[4] Proc. Acad. Nat. Sci. Phila., 1854, p. 27, *Catostomus clarki;* U. S. and Mex. Bound. Surv. Ichthyol., p. 38, pl. 22, *Minomus clarki;* Bull. 47, U. S. Nat. Mus., p. 170, *Pantosteus arizonae;* Proc. U. S. Nat. Mus., vol. 20, p. 488, pl. 36; U. S. Geol. Surv. Wyoming, Fourth Ann. Rept., 1870 (1871), p. 435, *Minomus delphinus.*

Of the other species, *P. arizonae* has a skull of similar structure, and very large scales above the lateral line. A comparison of the type of *P. arizonae* and cotypes of *C. clarki* indicates that they are specimens of the same species. The scales in the lateral series are found to number from 62 to 75, the series between lateral line and back 7 to 9, between lateral line and ventrals 11 to 14, between occiput and dorsal fin 15 to 17.

Specimens from Beaver Creek.

Lateral line	69	68	70	66	66	70	62	64
Above lateral line	9	8	9	8	7	9	7	9
Below lateral line	10	10	10	11	10	10	11	9
Before dorsal	16	15	16	17	17	17	15	17

Type and paratype P. arizonae.

Lateral line	67	69
Above lateral line	8	8
Below lateral line	11	11
Before dorsal	16	17

Cotypes of C. clarki.

Lateral line	65	66
Above lateral line	8	9
Below lateral line	11	10
Before dorsal	17	17

There is no material difference in the form of the body, proportions of various parts, fin rays, etc., as the following table of measurements will indicate:

	Cotypes of *C. clarki.*		Paratype and type of *P. arizonae.*		Examples from Beaver Creek.					
	1	2	3	4	5	6	7	8	9	10
Length of body	125	115	85	170	195	185	195	205	197	187
Length head	0.22	0.235	0.23	0.23	0.23	0.215	0.22	0.22	0.22	0.215
Depth caudal peduncle	.08	.09	.08	.08	.08	.085	.085	.08	.08	.085
Length caudal peduncle	.155	.14	.16	.16	.155	.14	.145	.14	.15	.15
Length snout	.115	.12	.11	.13	.12	.125	.11	.125	.115	.115
Diameter eye	.05	.05	.05	.04	.042	.04	.04	.045	.04	.045
Interorbital width	.09	.09	.09	.10	.09	.10	.09	.10	.09	.095
Depth head	.15	.15	.155	.15	.15	.15	.145	.14	.145	.145
Snout to occiput	.20	.21	.21	.205	.19	.19	.19	.19	.20	.19
Snout to dorsal	.49	.50	.50	.50	.52	.485	.48	.51	.49	.50
Snout to ventral	.58	.60	.61	.58	.61	.62	.60	.62	.59	.60
Length base of dorsal	.15	.14	.14	.175	.16	.155	.17	.155	.16	.165
Length base of anal	.085	.08	.08	.09	.08	.08	.09	.08	.085	.09
Height dorsal	.15	.16	....	....	.185	.175	.18	.18	.18	.18
Height anal	.20	.18	.20	.19	.20	.195	.21	.185	.20	.22
Length pectoral	.18	.20	.20	.19	.20	.18	.205	.18	.18	.21
Length ventral	.155	.16	.17	.175	.16	.16	.16	.15	.16	.19
Dorsal rays	11	10	10	12	11	12	11	11	11	11
Anal rays	7	7	7	7	7	7	7	7	7	7

The other recognized Colorado species has been considered synonymous with *P. bardus* and *P. virescens*, described by Cope.[1] The types of *P. delphinus* and *P. bardus* are lost, and the locality from which these and *P. virescens* came is not known with certainty. The descriptions of all are equally brief. The type of *P. virescens* (No. 16758, U.S.N.M.) remains. It is apparently of the same species as others in the United States National Museum identified by late investigators as *P. delphinus*. It measures 370 mm., being by far the largest specimen of the genus which the writer has seen.[2] There is some reason to suspect that this is not synonymous with *P. delphinus* (Cope), for that authority distinguishes the latter by its short, wide head and thick body. He also says that the scales are subequal. The type of *P. virescens* is relatively slender and the scales of the anterior dorsal surface are much smaller than the others, a fact which Cope records. However, as no more important reason appears for distinguishing between *P. delphinus* and *P. virescens*, they are here regarded as synonymous. The skull of this species is relatively thin and the fontanelle constantly remains open.

Unless the present treatment of these nominal forms is at fault it is evident that there are but two species of *Pantosteus* (*Pantosteus* and *Notolepidomyzon*) in the Colorado system. Both are easily distinguished from species of *Catostomus* by the structure of the lips, and they differ markedly from each other in the size of the scales. When the crania of both are compared, it is observed that the heavy, firm skull of *N. clarki*, with its closely fitting frontals and parietals, contrasts strongly with the comparatively light, thin skull of *P. delphinus*, the sharp-edged frontals and parietals of which are separated by an elongate and narrow fontanelle.

With these Colorado forms in mind it will be of interest to examine similar catostomids of the Bonneville Basin, where three species have been described, *Catostomus generosus* Girard, *Minomus platyrhynchus* Cope, and *Minomus jarrovii* Cope,[3] only one of which has been generally recognized. The cotypes of *C. generosus* and *M. platyrhynchus* are preserved in the Museum. The former represents a species with a short, robust body and a very thick skull without fontanelle, hence belonging to *Notolepidomyzon*, while *M. platyrhynchus* is relatively slender and has a thin skull with an elongate, narrow fontanelle,[4] a member of the genus *Pantosteus*. The cotypes of *jarrovii* can not be found. Cope remarks that this is a less elongate species than *platyrhynchus*, thus lending color to the supposition that his observations were made on an example of *generosus*. It is also worth while to note that the original description refers only to "several specimens from near Provo. Messrs. Yarrow and Henshaw." There can then be no mistake as to the type-locality, and apparently no good reason to assume that any cotypes came from the Rio Grande.[1]

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[1] U. S. Geol. Surv. Wyoming, Fourth Ann. Rept. for 1870 (1871), p. 436, *Minomus bardus*. Wheeler's Explor. West of the 100th Merid., vol. 5, 1875 (1876), p. 675, *P. virescens*.

[2] Numerous specimens of *Pantosteus* measuring from 230 to 395 mm., the largest of which weighed 1½ pounds, were lately collected by the writer while engaged in a survey of the Bonneville system under the direction of the United States Bureau of Fisheries. In these the fontanelle is present.

[3] Proc. Acad. Nat. Sci. Phila., 1856, p. 174. Proc. Amer. Philos. Soc. Phila., 1874, pp. 134, 135.

[4] The fontanelle, covered or closed as usual with a tough membrane, must have escaped the attention of Cope, as *M. platyrhynchus* is the first species mentioned and described under his diagnosis of the genus *Pantosteus*, which he characterizes by "a complete union of the parietal bones which obliterates the fontanelle so universal among the suckers."

The Lahontan system has one species, *P. lahontan* Rutter,[2] which is related to *P. platyrhynchus*, each resembling the other closely both in cranial structure and external characteristics. One form, *P. jordani*[3] Evermann described from the upper part of the Missouri Basin, seems to be a representative of *P. platyrhynchus*, although the fontanelle is reduced to a very narrow slip. But one species seems to be known from the Rio Grande, *Catostomus plebeius* Baird and Girard.[4] It has the thick skull without fontanelle characteristic of *Notolepidomyzon*. Santa Ana River, a coastal stream of southern California, contains one species *santa-anae*, a member of the same genus. Its describer was mistaken in its relationships, having compared it with wrongly identified specimens.[5]

The relationships here indicated, and which are believed to be in harmony with both the structure and geographic distribution of the species in question, may be indicated as follows:

Lips with a horny cutting edge; cranium thin; a narrow and usually slitlike fontanelle present (fig. 2):

Pantosteus—
  delphinus Colorado.
  platyrhynchus Bonneville.
  jordani Columbia.
  lahontan Lahontan.

Lips with a horny cutting edge; cranium thick; no fontanelle (fig. 1):

Notolepidomyzon—
  clarki Colorado.
  santa-anae Santa Ana.
  generosus Bonneville.
  plebeius Rio Grande.

The center of distribution of each genus is the Bonneville Basin.

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[1] Bull. U. S. Fish. Comm., No. 12, 1892, p. 56. List of specimens of *Pantosteus* now found in the U. S. National Museum.

[2] Bull. U. S. Fish Comm., No. 22, 1902, p. 146.

[3] Bull. U. S. Fish Comm., No. 12, 1892, p. 51. The writer follows Jordan and Evermann in identifying *P. columbianus* Eigenmann (Amer. Naturalist, February 4, 1893, p. 151) with *P. jordani*, not having sufficient material for a careful comparison. A few poorly preserved specimens from the Columbia indicate that this identification should be accepted provisionally, for the two may be distinct species. There is danger of confusing this form with *C. catostomus*. The latter has a narrow, rectangular fontanelle.

[4] Proc. Acad. Nat. Sci. Phila., 1854, p. 28.

[5] Proc. U. S. Nat. Mus., vol. 34, 1908, p. 33.

One is justified in looking forward to the possible discovery of one or even more undescribed forms, or at least to the extension of the range, of known species. It is quite within reason to presume that *N. generosus* is represented in the upper Columbia Basin. The status of *platyrhynchus*, *jordani*, and *columbianus* should be carefully investigated.

The specimens here used for comparison were about 6 inches long, perhaps the average size of mature individuals. In very old examples of *Pantosteus* the fontanelle becomes linear. In the large type of *P. virescens* the parietals and frontals nearly meet.

The smallest specimen of *N. clarki* examined measured 70 mm. in length. No fontanelle was present, but the parietals and frontals were not very firmly united along the median line.

Beaver Creek, Santa Cruz River.

XYRAUCHEN TEXANUS Abbott.[1]

This species is remarkable for the high and narrow dorsal hump or keel which rises abruptly from the rather low, flat head, and extends to the dorsal fin. The bony structure of this keel is formed by the junction of an enlarged occipital crest and a series of fused or closely apposed and modified spines and interneurals. The anterior and stronger part of the crest is supported by the complex of vertebrae over which the chain of Weberian ossicles extends (fig. 6). This complex involves 3 developed vertebrae, no trace of another appearing in the mature skeleton. The first of these is represented by a thin centrum without lateral processes, above which is the spine (*S.1*), narrow and knife-like, with a heavy, thick base, closely apposed to the first interneural (*i.1.*), the base of the second vertebral spine and the neural arch. The second vertebra is not ankylosed with either the first or third. Its neural arch is large, and the spine (*S. 2*) above it is massive. With the second spine are firmly coosified the broad, leaf-like interneurals between the first and fifth spines. This spine-interneural complex is the "trapezoidal interneural" of Lockington[2] and the "large, interneural formed by a thick central pillar with anterior and posterior wings" of Kirsch.[3] The third spine (*S. 3*) is broad and low, closely joined to the base of the second, or ankylosed with it. The fourth is slender, short, and supplied with a bifid tip which clasps the lower edges of the last fused interneurals. Five other interneurals (one of which is occasionally absent or partly developed) with thin, broad tips and narrow, pointed bases, together with the first interneural of the dorsal fin finally complete the bony crest.

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[1] Fowler finds that *X. cypho* of authors is *C. texanus* Abbott. Proc. Acad. Nat. Sci. Phila., 1913, p. 54.

[2] Proc. Acad. Nat. Sci. Phila., 1880, p. 237.

[3] Proc. U.S.Nat.Mus., vol. 11, 1888, p. 556, description of *Xyrauchen* Eigenmann and Kirsch, new genus.

An osseous crest not much unlike this is present in *Carpiodes* and *Ictiobus*, the elements being especially distinct in the latter (fig. 5). It is rather feebly represented in *Catostomus*, where the coosified part of the crest involves the spines and interneurals anterior to and including the sixth vertebra. The fourth, fifth, and sixth spines only are easily distinguished, their tips extending upward astride a knife-like blade formed by the ankylosed interneurals.

The skull of *Xyrauchen* differs greatly from that of *Catostomus*, as will be seen by a comparison of the illustrations (figs. 3 and 4). The fontanelle in *Xyrauchen* is broad anteriorly, narrow posteriorly, almost triangular in shape, the posterior part continued backward and upward as a narrow trough on the base of the occipital crest. In *Catostomus* (*insignis*, *commersoni*, *macrocheilus*, *mniotiltus*, *tahoensis*) the foramen is broad, oblong, and more or less rectangular.

This and other peculiar cranial characteristics of *Xyrauchen* indicate no very close relationship between it and *Catostomus*.

The dorsal crest of the species is exaggerated in old age by the flattening of the head, the dorsal contour of which becomes strongly concave in contrast to the convex skulls of *Catostomus*, *Carpiodes*, and others.

Doctor Mearns notes that the flesh of this species is excellent and of fine flavor.

Specimens were collected in the Colorado at Yuma, where one example with a peculiar abnormal squamation appeared, the scales being only about half the usual size, except in several very restricted areas, where a few normal ones were found.

Very large specimens, refusing to take a hook, were snared in deep holes among the rocks. A line with several hooks attached was allowed to sink to the bottom and when a school moved over it the line was brought out with a sharp swish of the pole, a sucker usually being hooked.

The entire ventral surface is orange yellow; pectoral and ventral fins very slightly dusky, their upper surface marked basally with dusky olive; iris yellow, with greenish-yellow granulation; lower third of head, including end of snout, orange yellow, in strong contrast with the flesh-colored mouth; sides salmon color, granulated with dusky olive; dorsal surface, including top of head, dark olive brown; anterior ridge of hump pale olive. Dorsal fin olivaceous; anal orange yellow, indistinctly marked with dusky; caudal yellowish olive. In some examples the fins are rather rosy, and the scales of the sides are tipped with silvery. An occasional example has the dorsal surface dark olive brown, and there is a strong pinkish tint below the lateral line.

Colorado River at Yuma; Gila River at Gila City.

GILA ELEGANS Baird and Girard.

There is one example in the collection which measures 15¾ inches in length. The head is greatly flattened and a broad, rounded, nuchal hump is developed.

The very narrow caudal peduncle, the depressed and elongate head, and the dorsal hump of *G. elegans* calls to mind the fact that these peculiarities are characteristic of other Colorado forms. An unusually narrow caudal peduncle distinguishes *C. latipinnis* and *G. elegans*, the depressed head is found in *Ptychocheilus lucius*, *G. robusta*, and *X. texanus*, and the dorsal crest is conspicuous in *X. texanus* and *G. robusta*. These characters become fully developed only in old individuals.

Gila River at Gila City; Colorado River, Yuma; Salton River, Colorado Desert, Lower California.

GILA ROBUSTA Cope.

In large individuals the back is greatly arched, the head flattened, and concave in outline. The maxillary appears longer, the tip extending beyond anterior margin of eye, which it does not reach in small specimens.

G. seminuda[1] seems to be synonymous with this species. In the ventral region the scales are small, thin, and not securely embedded. The observations of Ellis,[2] "Specimens of this subspecies differ from the typical *G. robusta* in having no scales in the midventral portion of the body as far posterior as the base of the ventrals and no scales on the mid-dorsal region as far back as the middle or last ray of the dorsal fin," are not applicable to this form, as the cotypes of *G. seminuda* from the Rio Virgen have the entire ventral surface scaled, where the scales have not been displaced by accident, in which case the pockets remain. The same is also true of the mid-dorsal region.

Fishes of this species may be caught with baited hook, "the flesh of a bird or minnows of its own species answering equally well. The stomach of one specimen contained a frog."

An example measuring 9½ inches from the Verde was colored in life as follows:

> Dorsal aspect dark, dotted with gold and silver; sides with obsolete blackish bands, most distinct toward the tail; below, silvery white; iris, golden; peritoneum, black. A smaller specimen was lighter colored and had a gold band extending from the superior extremity of the opercular opening to the base of the tail. In many specimens the ventral surface ranges in color from pure white to rosy salmon.
>
> The species is locally known as bony-tail or Verde trout, and when taken from cool water the flesh has an excellent flavor.

Verde River at Fort Verde; Gila River at Gila City.

PTYCHOCHEILUS LUCIUS Girard.

Colorado River at Yuma; Gila River.

RICHARDSONIUS GIBBOSUS (Baird and Girard).

In determining the identity of specimens collected by Doctor Mearns it became necessary to examine the types of *Gila gibbosa*

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[1] Wheeler's Explor West of the 100th Merid., vol. 5, 1875 (1876), p. 666, pl. 31, figs. 1, 1a.

[2] Fishes of Colorado, Univ. of Colorado Studies, 1914, p. 57, *Gila robusta seminuda*.

Baird and Girard,[1] *Tigoma intermedia* Girard,[2] and *Gila nigra* Cope.[3] It was found that they represent the same species.

The type of *G. gibbosa*, No. 223, U.S.N.M., is from the Rio Santa Cruz, a tributary of the Gila. The following measurements of the specimen are recorded in hundredths of the length to base of caudal fin. Length, 170 mm.; length head, 0.285; depth caudal peduncle, 0.105; length caudal peduncle, 0.20; length snout, 0.08; diameter eye, 0.055; interorbital width, 0.09; depth head, 0.19; snout to occiput, 0.20; to dorsal, 0.58; to ventral, 0.54; length base of dorsal, 0.18; base of anal, 0.09; height dorsal, 0.16; anal, 0.145; length pectoral, 0.16; length ventral, 0.12; number dorsal rays, 8; anal, 8; scales in lateral series, 74; between lateral line and middle of back, 19; between occiput and dorsal fin, 36.

One of the cotypes of *T. intermedia*, No. 232, U.S.N.M., has 76 scales in the lateral series, 20 above the lateral line, and 39 between occiput and dorsal fin. There are about 8 small, short gillrakers.

The cotypes of *G. nigra*, No. 16987, U.S.N.M., are from Ash Creek, Arizona. Specimens from San Carlos are also recorded by Cope, but they should not be regarded as cotypes[4] as the original description is based on larger examples, "7¼ inches," those from San Carlos being much smaller.

Specimens from Clear Creek about 20 miles above its confluence with the Verde were examined about July 2. The back was dark olive green, the sides golden yellow; sides of head brassy yellow granulated with black; ventral region yellow; iris yellow. Fins orange, the area around their bases vermilion.

Santa Cruz River, Verde River near Fort Verde.

A few fishes from Bear Creek, a tributary of Altar River, are provisionally identified as *R. gibbosus*. They appear to differ in form and scale characters from members of the genus taken in the Colorado and in the Yaqui. Material for a careful comparison is not available, however.

RICHARDSONIUS PURPUREUS (Girard).

This species has a robust body, large head, and very short snout. The gillrakers are very short, scarcely evident in some specimens. The scales in the lateral series number from 55 to 60; above lateral line, 15 or 16; between lateral line and ventral, 8 or 9; between occiput and dorsal, 34 to 36. Dorsal rays, 8; anal rays, 8.

San Bernardino River.

NOTROPIS MEARNSI, new species.

Five specimens of a *Notropis*, which apparently belongs to an unknown form, were collected in the Yaqui Basin. The species which is named in honor of its discoverer is characterized by the rather rounded and elongate body, slender caudal peduncle, posterior position of the dorsal fin, large scales, large eye, teeth 4–5, short alimentary canal, almost complete lateral line, and the absence of dark bars or spots.

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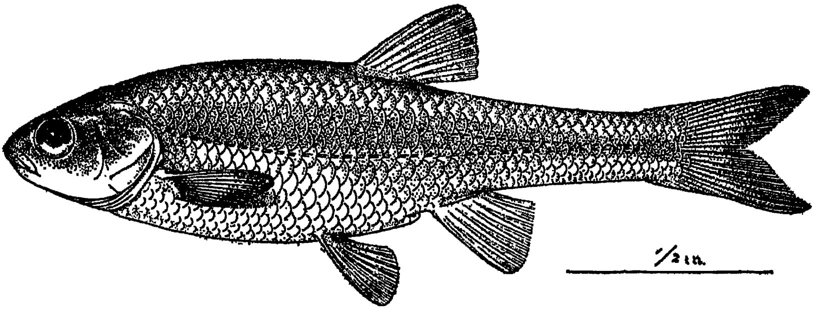
[1] Proc. Acad. Nat. Sci. Phila., 1854, p. 28; U. S. and Mex. Bound. Surv. Ichthyol., p. 64, pl. 33, figs. 1–4.
[2] Proc. Acad. Nat. Sci. Phila., 1856, p. 206.
[3] Wheeler's Explor. West of the 100th Merid., vol. 5, 1876, p. 663, pl. 30, fig. 3.
[4] Bull. 47, U. S. Nat. Mus., p. 235, synonymy of *L. niger*.

On comparison with other forms the exact relationships of the species do not appear. It is probably allied to some form indigenous to the Rio Grande.

Description of *Notropis mearnsi*, type No. 76163, U.S.N.M., from San Bernardino River, Mexico, near monument 77 of the international boundary; Dr. E. A. Mearns, collector; October 6, 1893.

Head 4.1 in length to base of caudal; depth, 3.9; depth caudal peduncle, 10; scales lateral series, 40; between lateral line and middle of back, 8; between occiput and insertion of dorsal, 19; dorsal rays, 8; anal, 8.



NOTROPIS MEARNSI.

Snout rather pointed, the length about equal to diameter of eye. Cleft of mouth oblique, extending slightly beyond anterior border of orbit. Dorsal inserted behind a vertical through base of ventral. Caudal deeply notched, the lobes pointed; 4 or 5 upper and lower rays not fully developed. Edges of dorsal, anal, and ventrals convex; pectorals obtusely pointed. Teeth 4 on the right side, 5 on the left; strong, pointed, with hooked tips; a narrow grinding surface present. Peritoneum silvery; a few dusky spots on its dorsal surface; lining of opercle silvery. Alimentary canal shorter than body, folded once and back. (Viscera and teeth from paratype.) Pseudobranchiae very large; 4 or 5 very short stubby gill rakers.

Scales large and regular. Lateral line complete or nearly so; slightly decurved anteriorly.

Color silvery, darker and with little luster on the dorsal surface; a broad, lateral, silvery stripe present, which gradually narrows on caudal peduncle; no bars or spots; a linear, black stripe, not parallel with the lateral line, extends from below dorsal fin nearly to base of caudal.

The paratypes exhibit some variation, as illustrated in the annexed table. The pores of the lateral line fail to develop on occasional scales, especially on the caudal peduncle.

Notropis mearnsi.—Measurements of type and paratypes.

Length of body ... mm.	41	40	35
Length head	0.26	0.25	0.255
Depth body	.27	.28	.28
Depth caudal peduncle	.10	.10	.11
Length caudal peduncle	...	.21	.25
Length snout	.06	.07	.07
Diameter eye	.065	.065	.07
Interorbital width	.075	.085	.085
Depth head	.19	.18	.19
Snout to occiput	.21	.20	.21
Snout to dorsal	.55	.58	.55
Snout to ventral	.50	.50	.51
Length base of dorsal	.12	.13	.14
Length base of anal	.115	.13	.12
Height dorsal	.20	.21	.21
Height anal	.17	.16	.19
Length pectoral	.19	.20	.22
Length ventral	.17	.14	.17
Length caudal	.26	.27	...
Dorsal rays	8	8	8
Anal rays	8	9	9
Scales lateral line	40	37	38
Scales above lateral line	8	8	8
Scales below lateral line	5	4	4
Scales before dorsal	19	18	17

AGOSIA CHRYSOGASTER Girard.

The teeth of 10 specimens were examined and found to have a well-developed grinding surface. They were sharp and distinctly hooked at the tips. There were 4 on each side. The fins are unusually short and rounded in some cases, the ventrals not reaching the anal opening. Tubercles are present on the heads of the males taken in January, and the females contain many eggs in various stages of development, some very large, apparently ripe. The peritoneum is dark; almost black.

Doctor Mearns observes of the color:

> Blackish above, greenish olive on the sides, and white below. Steel-blue reflections on sides of head.

Sonoyta River.

PLAGOPTERUS ARGENTISSIMUS Cope.

Three specimens of this interesting spined minnow bear rudimentary scales on the anterior dorsal parts of the body. On the throat, just posterior to the lower lip, is a mass of papillae like those on the lips of *Catostomus*.

Gila River, near Gila City.

SALMO IRIDEUS Gibbons.

A specimen 8½ inches long from Oak Creek appears to represent fishes that have been introduced from some California stream. It is a beautiful trout with a very deep body and small head. The adipose dorsal is short and unusually high. The dorsal half of the body is closely covered with spots, sharply outlined and perfectly round on the head where they are about half as large as the pupil; smaller and irregular in outline on the body, many of them somewhat X-shaped. The dorsal and caudal are closely covered with very small spots, the dorsal with a row of elongate ones along the base. Lower half of head and body, pectorals, ventrals, and anal immaculate. No teeth occur on the tongue posterior to those of the glossohyal. There are 140 rows of scales in the lateral series.

Specimens of this same trout with 116 to 120 scales in the lateral line and measuring about 15 inches are recorded by Doctor Mearns from Clear Creek.

This creek runs in a canyon with walls over a thousand feet high. At the bottom along the stream is a forest of Douglas spruce, willow, aspen, walnut, maple, box-elder, pine, and hackberry. There is a dense growth of hop and grape vines together with shrubs, annuals and ferns. The canyon walls are of limestone above, sandstone below.

Color above, a dark vinaceous olive, becoming silvery below the lateral line and yellowish beneath and on the opercles. Dorsal yellowish olive, thickly spotted; paired fins reddish orange, obscurely spotted with dusky. Back and sides densely spotted with black, the spots on head, back, and adipose fin being rounded, those on sides and posterior parts irregularly X-shaped. The iris is golden, as are the opercles and preopercles in places. On August 13 a female full of large eggs and measuring 19½ inches was taken in Oak Creek. The color was similar to that described above. Peritoneum whitish or colorless. A smaller one, 13 inches long, differed only in being whitish below. Other trout from Oak Creek were pure white below between the pectoral and ventral fins; the sides to or above the lateral line, greenish yellow; above lateral line the ground color was olivaceous; iris yellow; mottled with black; sides of head brassy yellow; dorsal and caudal greenish yellow.

The stomachs often contained quantities of sand and small pebbles. Wasps, grasshoppers, and grubs were frequently found there also. The largest trout caught weighed somewhat more than 3 pounds. June is the best month for fishing, when the trout are found high up toward the source of the brook.

Oak Creek.

POECILIA OCCIDENTALIS (Baird and Girard).

Specimens collected by Herbert Brown in Santa Cruz River near Tucson, November 20, 1893, contained eyed embryos. In one example, measuring 2½ inches, there were 15 such young, besides many embryos and eggs in various stages of development.

Gila River near Gila City and Adonde Siding; Santa Cruz River; San Bernardino River; Cajon Bonito Creek.

CYPRINODON MACULARIUS Baird and Girard.

Examples collected in the Sonoyta February 1 are thus described by Doctor Mearns.

The females of this species are beautifully banded with black on a ground of greenish olive above and white below. The posterior portion of the opercle is bright steel-blue. The males are not sharply banded and the colors are plainer. They are very tenacious of life, and ascend small streams, entering cold springs whenever possible.

Gila River at Gila City and Adonde Siding; Sonoyta River; spring near Sonoyta River.

EXPLANATION OF PLATES.

Plate 76.

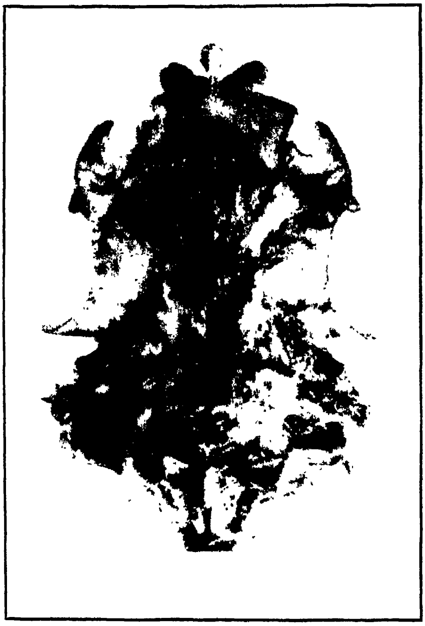
Crania of catostomids.

Fig. 1. *Notolepidomyzon clarki* X 2. Beaver Creek, Arizona.
2. *Pantosteus lahontan* X 3. Humboldt River, Nevada.
3. *Catostomus insignis* H 1. Colorado River, Arizona.
4. *Xyrauchen cypho* X ¾. Rio Verde, Arizona.

Plate 77.

Osseous structure of the dorsal crests of

Fig. 5. *Ictiobus bubalus*
6. *Xyrauchen texanus* Colorado River, Arizona.



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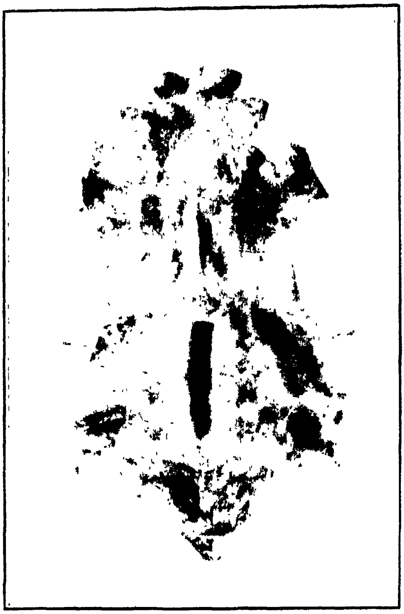

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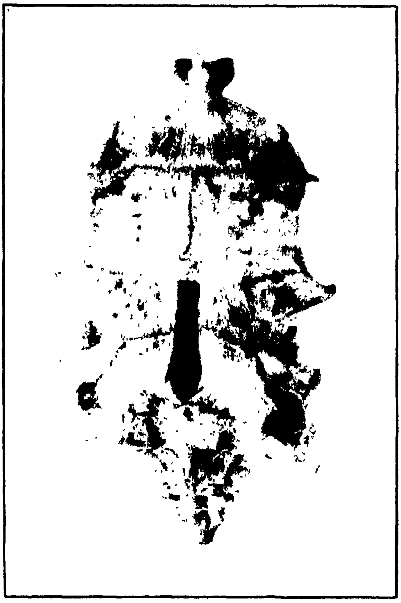

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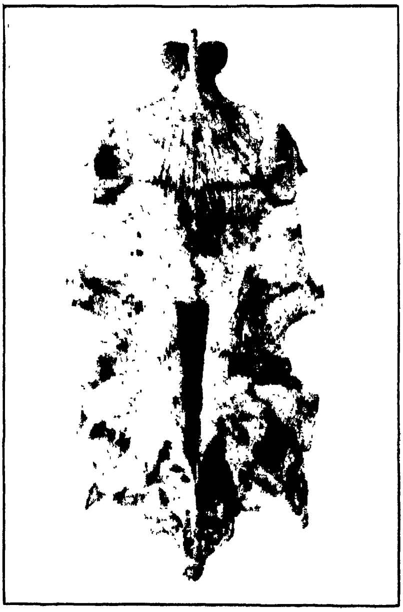
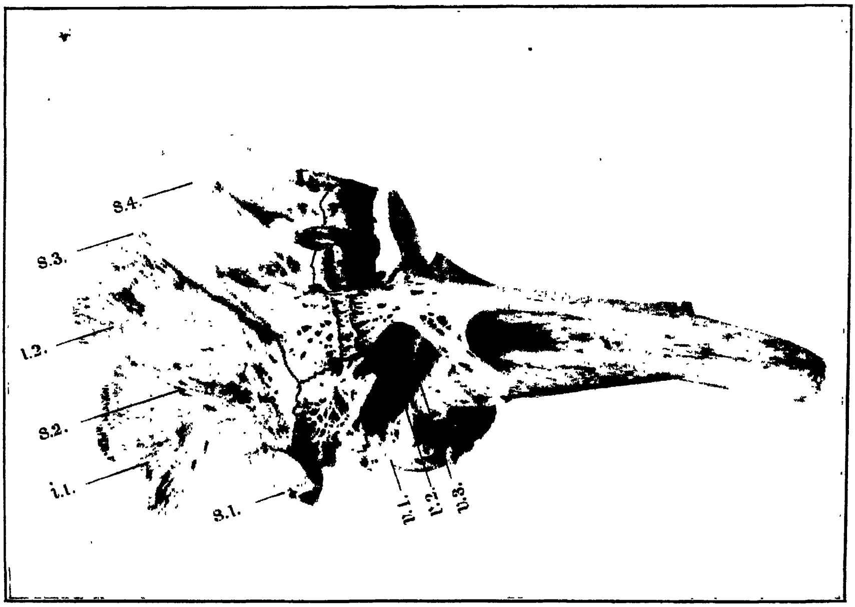


4

OSTEOLOGY OF FISHES.

FOR EXPLANATION OF PLATE SEE PAGE 586.



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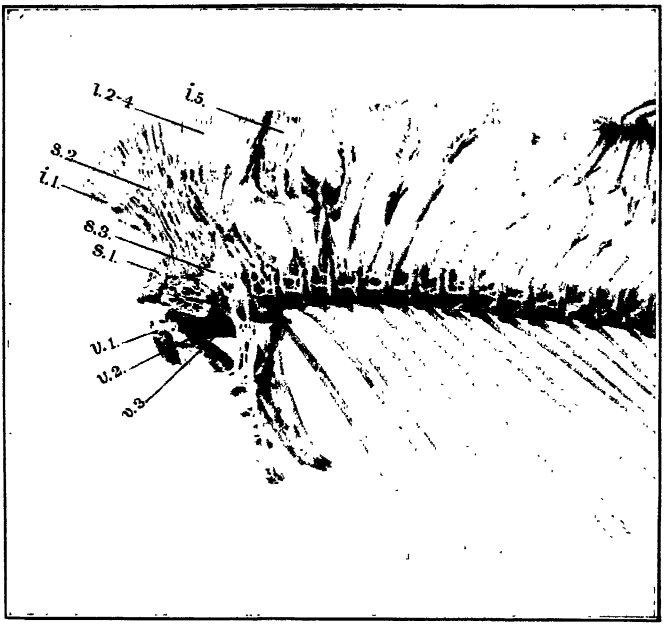

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Osteology of Fishes.

NEW FRESH-WATER SHELLS FROM THE OZARK MOUNTAINS.

By Anson A. Hinkley,
Of Dubois, Illinois.

During August, 1914, the writer spent two weeks collecting in the Ozark region, chiefly at Galena, Missouri; Cotter, Norfolk, and Black Rock, Arkansas. An interesting series of fresh-water species was obtained, of which several appear to be new. Descriptions of these are given below with a list of the species collected.

ANCULOSA ARKANSENSIS, new species.

Plate 78, fig. 3.

Shell smooth, conical; whorls five, convex; suture impressed. Aperture large, oval; labrum straight, a slight sinus at the base of the columella; columellar callus brown, thick and curved across the parietal wall, slightly indented in the umbilical region. Shell yellowish or straw-color externally with six faint, narrow, brownish bands, showing the same in the aperture. The type, Cat. No. 271764, U.S.N.M., measures: Height, 10 mm.; diameter, 7 mm.

This species was found in the North Fork of White River 2 or 3 miles above Norfolk, Arkansas. A very few were taken at Cotter, Arkansas.

This is the first *Anculosa* known from west of the Mississippi River. Compared with *A. subglobosa*, it is smaller, spire more produced, aperture not as wide. It is nearer to *A. virgata* but is smaller, more solid, lighter colored, and has the character of the bands different when present.

The more elevated specimens resemble short wide forms of *Goniobasis plebeius*, but that species has an angular body-whorl and differs in the aperture and callus. The difference is strongly marked in the young specimens. The young *A. arkansensis* has a striking resemblance to some of the species of *Somatogyrus*. An occasional specimen has two broad bands with a light zone between of about the same width. A light-colored band below the suture is shown on many specimens.

PYRGULOPSIS OZARKENSIS, new species.

Plate 78, fig. 2.

The shell is imperforate, conical, smooth, whitish horn-colored; whorls five, convex; the suture impressed. The aperture is holostomate, oblique, widely ovate; columellar callus thick, the outer edge slightly raised, and curved. The outer lip thickened, extending beyond the outline of the spire. The type, Cat. No. 271765, U.S.N.M., measures: Height, 3 mm.; diameter, 1.5 mm.

Found in shallow water on the bedrock of the North Fork of White River, 2 or 3 miles above Norfolk, Arkansas, on August 14, 1914.

Differs from *P. wabashensis* in the convex whorls, deeper suture, wider aperture, and the conical outline.

SOMATOGYRUS CRASSILABRIS, new species.

Plate 78, fig. 1.

Shell small, depressed, translucent whitish horn-color, of about four whorls; surface smooth but not polished, sculptured only with rather sharp but not conspicuous incremental lines; whorls rapidly increasing in size, markedly flattened in front of the suture, thence evenly rounded; base rounded, with a minute but distinct umbilicus; aperture obovate, the margin continuous, duplex, moderately and evenly thickened; aperture bluish white within. The type, Cat. No. 271763, U.S.N.M., measures: Height, 4.5 mm.; maximum diameter, 3.5 mm.

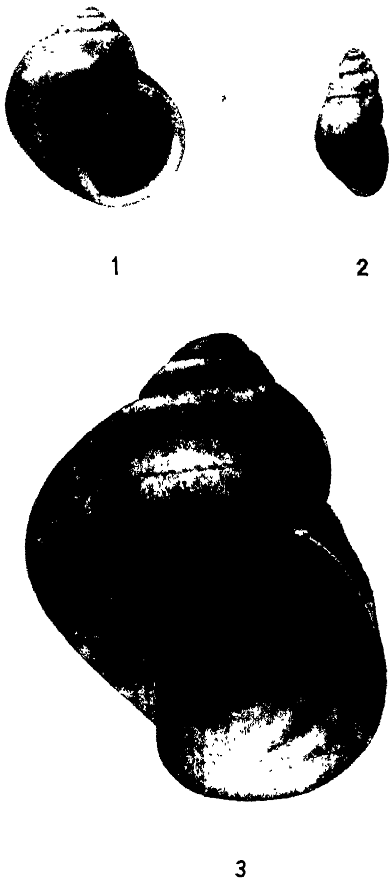
Collected by A. A. Hinkley, in 1914, in North Fork of the White River, at Norfolk, Arkansas.

LIST OF SPECIES COLLECTED.

G=collected at Galena, Missouri; C=collected at Cotter, Arkansas; N=collected at Norfolk, Arkansas; B=collected at Black Rock, Arkansas; S=collected at Spring River.

Truncilla triquetra Rafinesque, C.
Lampsilis ventricosus Barnes, G. C. N. B. S
Lampsilis breviculus brittsi Simpson, G. C. N.
Lampsilis luteolus Lamarck, G. C.
Lampsilis ellipsiformis Conrad var., G. C.
Lampsilis ligamentinus Lamarck, C. B. S.
Lampsilis orbiculatus Hildreth, C. N. B. S.
Lampsilis rectus Lamarck, G. C. N.
Lampsilis subrostratus Say, G.
Lampsilis lienosus Conrad, N.
Lampsilis iris Lea, G. C.
Lampsilis glans, G.
Lampsilis purpuratus Lamarck, C. S.
Lampsilis gracilis Barnes, C. N. B. S.
Lampsilis leptodon Rafinesque, G. C.
Obovaria ellipsis Lea, B.
Plagiola securis Lea, C. N. B. S.
Plagiola elegans Lea, C. N. B.
Plagiola donaciformis Linnaeus, B.
Tritogonia tuberculata Barnes, C. N. B. S.
Cyprogenia aberti Conrad, C. N. B. S.
Obliquaria reflexa Rafinesque, B. S.
Ptychobranchus clintonensis Simpson, G. C. N.
Strophitus edentulus Say, G. C. N. B. S.
Anodonta imbecilis Say, G.
Anodonta suborbiculata Say (pond), S.
Anodonta grandis Say. C.
Symphynota complanata Barnes, C.
Symphynota costata Rafinesque, G. C. N. B. S.
Alasmidonta calceola Lea, G. C.
Alasmidonta truncata B. H. Wright, G. C. N. B. S.
Unio gibbosus Barnes, G. C. N. B. S.
Pleurobema utterbacki Frierson, G. C. N. S.
Quadrula perplicata Conrad, C. N.
Quadrula undulata Barnes, G. B. S.
Quardula trapezoides Lea, B.
Quadrula cylindrica Say, C. N. B. S.
Quadrula metanevra Rafinesque, B. S.

Quadrula pustulosa Lea, C. N. B. S.
Quadrula trigona Lea, G. N. B. S.
Quadrula coccinea Conrad, C. N.
Quadrula solida Lea, C. N. B. S.
Quadrula pyramidata Lea, B. S.
Quadrula plena Lea, S.
Quadrula ebena Lea, N. B. S.
Quadrula tuberculata Rafinesque, G. C. N. B. S.
Sphaerium, species, C.
Sphaerium striatinum Lamarck, G.
Musculium transversum Say, G. N.
Pisidium, species, G. C.
Pisidium sargenti Sterki, G.
Pisidium compressum Prime, G.
Pisidium punctatum Sterki, G.
Pisidium friersoni Sterki, G.
Pisidium virginicum Bourguignat, G. N.
Campeloma subsolida Anthony, G. C. N. B. S.
Campeloma, species? B.
Vivipara contectoides Pinney (pond), S.
Vivipara subpurpurea, Say B.
Somatogyrus crassilabris Walker, N.
Somatogyrus subglobosus Say, B. S.
Amnicola cincinnatiensis Anthony, G. C. N. B. S.
Amnicola emarginata Küster, B.
Pyrgulopsis ozarki Hinkley, N.
Angitrema verrucosa Rafinesque, B. S.
Pleurocera elevatum Say, G. C. B.
Pleurocera subulare Lea, C. N.
Pleurocera moniliferum Lea, N.
Pleurocera alveare Conrad, B. S.
Pleurocera plicata Tryon?, C. N.
Goniobasis plebius Anthony, G. C. N.
Goniobasis, species, N.
Anculosa arkansasi Hinkley, C. N.
Physa gyrina Say G. C. N.
Physa crandalli Baker, G.
Planorbis (*Helisoma*) *trivolvis* Say. G. C.
Planorbis (*Helisoma*) *bicarinatus* Say, C.
Planorbis (*Gyraulus*) *parvus* Say, G.
Planorbis sampsoni, G.
Lymnaea obrussa Say, G. N.
Succinea concordialis Gould, G.



Fresh-Water Shells from the Ozark Mountains.

For explanation of plate see page 589.

OSTEOLOGY OF THESCELOSAURUS, AN ORTHOPODOUS DINOSAUR FROM THE LANCE FORMATION OF WYOMING.

By Charles W. Gilmore,

Assistant Curator of Fossil Reptiles, United States National Museum.

INTRODUCTION.

Since the preliminary description [1] of *Thescelosaurus neglectus* was published the preparation of the type-specimen has been completed and it is now proposed to give a more detailed account of the skeletal anatomy, and a fuller discussion of its affinities and relationships than was possible at the time of publishing the original article.

The finding in the United States National Museum collections of the portions of three individuals in addition to the type-specimens serves as excellent supplimentary material and enables me to describe more accurately certain parts of the skeleton that were either missing or badly damaged in the typical specimens.

OSTEOLOGY OF THESCELOSAURUS.

SUMMARY OF KNOWN MATERIAL.

Type, No. 7757, U.S.N.M. An articulated skeleton, lacking the skull and neck, and portions of humeri, scapulae, and coracoids. From Doegie Creek, Niobrara County,[2] Wyoming. Collected by J. B. Hatcher and W. H. Utterback, 1891.

Paratype, No. 7758, U.S.N.M. Consists of a few cervical, dorsal, and caudal vertebrae, portions of both scapulae, ribs, portions of fore and hind feet, and fragmentary limb bones. From Lance Creek, Niobrara County, Wyoming. Collected by O. A. Peterson, 1889.

No. 7760, U.S.N.M. Left scapula and coracoid. From Deer Ears Buttes, Butte County, South Dakota. Collected by J. B. Hatcher, 1891.

No. 7761, U.S.N.M. Cervical centrum. From "Beecher's Quarry," Niobrara County, Wyoming. Collected by Hatcher, Sullins, and Burrell, 1891.

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[1] Gilmore, Charles W., A new Dinosaur from the Lance Formation of Wyoming. Smith. Misc. Coll., vol. 61, No. 5, 1913, pp. 1-5, figs. 1-5.

[2] At the time these collections were made, Niobrara County was a part of Converse County.

No. 8065, U.S.N.M. Proximal phalanx of digit III of the pes. From Niobrara County, Wyoming. Collected by J. B. Hatcher, 1890.

No. 8016, ——, and 5031. The partial skeletons of three individuals in the American Museum of Natural History, New York, all from Dawson County, Montana. All collected by Barnum Brown.

THE VERTEBRAL COLUMN.

The vertebral column is intact and articulated from the anterior dorsal region to very near the tip of the tail. This series may be subdivided as follows: Presacrals (all dorsals) 16, sacrals 5, and caudals 48.

The number of cervicals is unknown; probably not more than nine, as in *Camptosaurus*. I am inclined to the belief that the dorsal series is complete as shown by the attachment of the most anterior sternal rib at the extreme outer corner of the sternal bone, thus leaving no room for the union of other ribs anterior to the sixteenth presacral.

The sacrum may be considered definitely determined as having five vertebrae. The tail lacks one or two vertebrae at the tip to complete the series. Tentatively the vertebral formula may be given as c9 ?, d16, s5, c50.

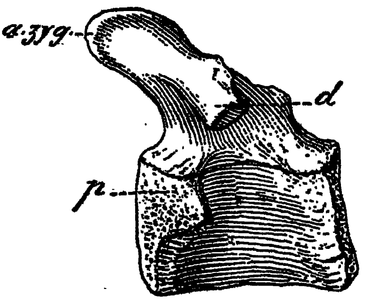

FIG. 1.—CERVICAL VERTEBRA OF THESCELOSAURUS NEGLECTUS GILMORE. PARATYPE. NO. 7758, U.S.N.M. ABOUT ¾ NAT. SIZE. VIEWED FROM LEFT SIDE. *a. zyg.*, ANTERIOR ZYGAPOPHYSIS; *d*, DIAPOPHYSIS; *p*, PARAPOPHYSIS.

Cervical vertebrae.—None of the cervical vertebrae was preserved with the type-specimen, but fragmentary parts of several pertaining to the paratype No. 7758, U.S.N.M., give a fairly good idea of the chief characteristics of the structure of the bones of the neck.

The centra are plano-concave, the concavity of the posterior end being very shallow. In contour the anterior end is shield-shaped, the upper border being slightly indented by the neural canal. The sides of the centra below the neuro-central suture are pinched in, but to a less degree than in *Camptosaurus*. Ventrally the centra are flattened. This surface is rugosely roughened and extends the entire length of the vertebra, being wider behind than in front, as shown in figure 2. This flattening of the cervicals appears distinctive of *Thescelosaurus*, for in all other dinosaurs the ventral surfaces are either keeled or broadly rounded.

The neural arches are attached to the centrum by broad pedicles, especially expanded on the anterior end, where they extend outward over the tops of the parapophysial buttresses. The neural canal is large.

In figure 1 is shown one of the cervicals from the posterior half of the neck, which has a rather slender diapophysial process which extends outward, backward, and slightly downward. The anterior zygapophyses have exceedingly broad articular surfaces placed wide apart.

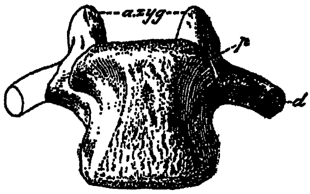

Fig. 2.—Cervical vertebra of Thescelosaurus neglectus Gilmore. Paratype. No. 7758, U.S.N.M. ½ nat. size. Ventral view. *a. zyg.*, anterior zygapophyses; *d*, diapophysis; *p*, parapophysis.

While nothing is known as to the precise number of vertebrae in the neck, there appears no good reason to expect a greater number than in *Hypsilophodon* or *Camptosaurus*, the latter having been definitely determined as having 9, which agrees with Huxley's[1] determination of the cervicals in *Hypsilophodon*, whereas Hulke[2] shows in his restoration only 8. Marsh[3] in his restoration of *Hypsilophodon* has certainly erred in increasing the number to 11. See plate 82.

The measurements of the centrum shown in figures 1 and 2 are: Greatest length, 40 mm.; greatest width, anterior end, 41 mm.; greatest height, anterior end, 27 mm.; greatest width, posterior end, 33 mm.

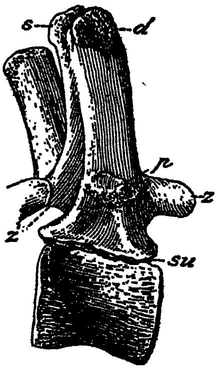

Fig. 3.—Fifteenth presacral vertebra, probably the 2d dorsal of Thescelosaurus neglectus Gilmore. Type. No. 7757, U.S.N.M. ½ nat. size. Lateral view. *d*, diapophysis; *p*, parapophysis; *s*, spinous process; *su*, neurocentral suture; *z*, anterior zygapophysis; *z'*, posterior zygapophysis.

Dorsal vertebrae.—The dorsal centra are slightly biconcave. In passing from the front toward the sacrum the centra gradually increase in length and in transverse diameter, reaching their maximum development in the last dorsal.

The flattened ventral surfaces of the cervicals change to a narrow rounded surface in the anterior dorsals, becoming progressively more and more broadly rounded as they approach the sacrum. For a short distance on either end of the centra, when viewed laterally, the surface is longitudinally corrugated, being especially pronounced on the ventral areas. The pinched-in depression of the cervicals changes in the dorsals, so that posterior to the mid-thoracic region the sides of the centra are approximately flat in the vertical direction. All are concave, however, longitudinally. All of the presacrals show stout transverse processes. In the anterior dorsal region these are relatively long (see fig. 3) with a capitular facet on the side of the arch. Proceeding posteriorly the transverse processes become shorter and the position of the facet changes from the side of the arch to the front border of the transverse process and approaches the tuberculum until on the fourth vertebra in front of the sacrum there is but a single facet on the end of the exceedingly heavy process (see *d*, fig. 5). This vertebra, as in the remaining dorsals, all carry single headed ribs.

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[1] Quart. Journ. Geol. Soc. London, vol. 26, 1870, p. 3, pl. 1.

[2] Philos. Trans. Roy. Soc. London, 1882, pp. 1035–1062, pl. 82.

[3] Dinosaurs of North America, 1896, pl. 84.

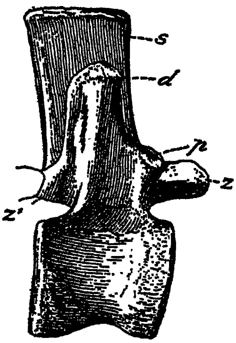

Fig. 4.—Eighth presacral vertebra of Thescelosaurus neglectus Gilmore. Type. No. 7757, U.S.N.M. ½ nat. size. Lateral view. *d*, Diapophysis; *p*, parapophysis; *s*, spinous process; *z*, anterior zygapophysis; *z′*, posterior zygapophysis.

The transverse processes of the anterior dorsals are directed upward at an angle of more than 45°, so that when viewed from the side they appear to equal the spinous process in height, as shown in figure 3. Proceeding posteriorly the upward inclination becomes less and less until in the posterior dorsals it extends out nearly horizontal (fig. 5). Throughout the series the point of origin of the transverse processes is especially low down on the arch, though higher in front than behind.

The spinous processes are thin rectangular plates of bone (figs. 4 and 5), with but little transverse expansion of their upper extremities. These gradually increase in height posteriorly, reaching their maximum development in the last dorsal (first presacral). The last dorsal (or sacro-dorsal) may be distinguished by its greater bulk and especially by the great transverse diameter of its posterior end. It is the largest vertebra of the entire vertebral column. As in all known dinosaurs, there are no true lumbar vertebrae, as all bear ribs. The average intercostal space between the dorsal vertebrae, as found articulated, is about 5 mm.

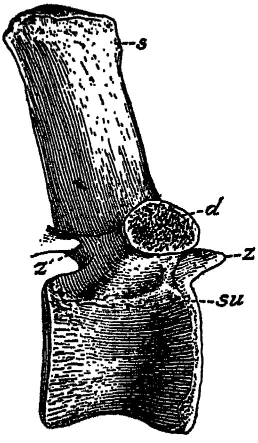

Fig. 5.—Third presacral vertebra of Thescelosaurus neglectus Gilmore. Type. No. 7757, U.S.N.M. ½ nat. size. Lateral view. *d*, Diapophysis; *s*, spinous process; *su*, suture; *z*, anterior zygapophysis; *z′*, posterior zygapophysis.

Sacrum.—The sacrum, as in *Hypsilophodon*, consists of five vertebrae that are directly united with the ilia by sacral ribs. These vertebrae are suturally united and appear to be firmly anchylosed. Sacral one may be distinguished from those that follow by the great transverse expansion of the anterior end of its centrum. The second sacral has the smallest centrum of the five and in cross-section is subcircular. The remaining three are more broadly rounded and but slightly concave antero-posteriorly. The first two sacral ribs unite with the centra intervertebrally, but the remaining three articulate laterally with their respective centra (fig. 17).

Passing outward from the centra the outer ends of the sacral ribs are expanded fore and aft to meet one another, becoming coalesced, and thus inclose a series of four sacral foramina. In *Hypsilophodon* the sacral ribs unite with the sacrals intervertebrally throughout the series, as they do in *Camptosaurus*. The spinous process of sacral one is distinct, but those of s^2, s^3, and s^4 (shown by the impressions in the rock) were closely joined and appear to have formed a continuous sheet of bone. The spinous process of the fifth is free. Viewed laterally, these spines extend but little above the superior borders of the ilia. The combined length of the five sacral centra is 195 mm.

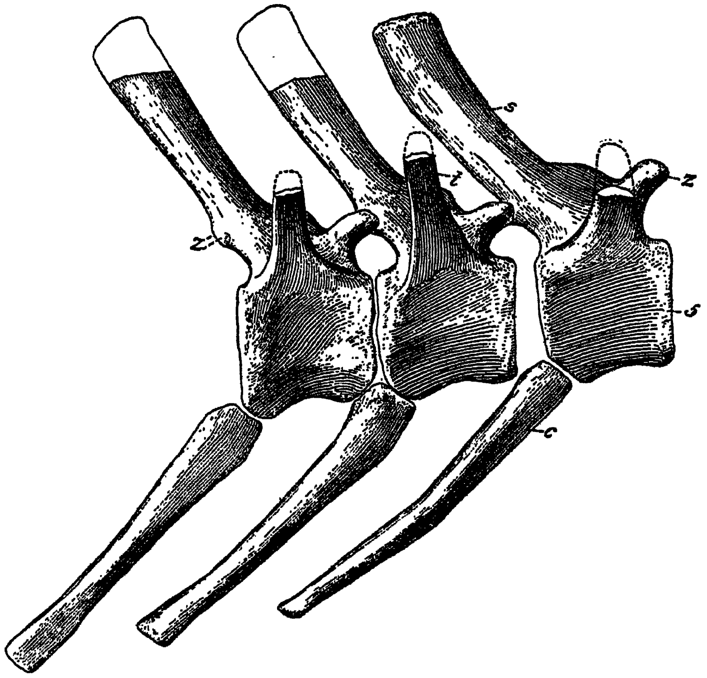

FIG. 6.—ANTERIOR CAUDAL VERTEBRAE (5TH, 6TH, AND 7TH) OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. NO. 7757, U.S.N.M. ⅓ NAT. SIZE. *c*, CHEVRON; *s*, SPINOUS PROCESS; *t*, TRANSVERSE PROCESS; *z*, ANTERIOR ZYGAPOPHYSIS; *z'*, POSTERIOR ZYGAPOPHYSIS; *5*, FIFTH CAUDAL.

Caudal vertebrae.—Forty-eight articulated caudal vertebrae are present with the type, and, as stated previously, it would appear as though two or more are missing from the tip of the tail, so that in *Thescelosaurus* the complete series would consist of at least 50 vertebrae. The first caudal may be recognized by the absence of chevron facets and the backward inclination of the spinous process. As in *Hypsilophodon*, the second caudal carries the first chevron. This is indicated in the type (No. 7757, U.S.N.M.) by a mutilated fragment found *in situ* between the second and third vertebrae, though the greater portions of the centra of these two vertebrae are missing.

Transverse processes are present in the first 10 caudals, whereas in *Hypsilophodon* the first 14 have transverse processes and in *Camptosaurus* the first 12. This process on the first caudal is shorter than those immediately succeeding it. They increase in length from the first to the fifth, and gradually shorten posteriorly, ending abruptly on the tenth, which has a length of 23 mm. All are given off from the side of the centra immediately below the level of the neuro-central suture (fig. 6). With the disappearance of the transverse processes the length of the centra is slightly increased and they become more cylindrical in shape (fig. 7). This increase in length continues back to the twentieth, and from this vertebra to the tip the centra gradually decrease in this diameter.

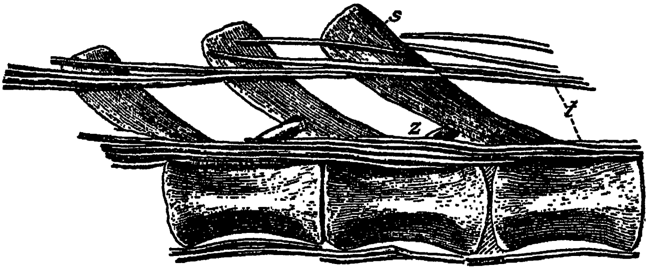

FIG. 7.—MEDIAN CAUDAL VERTEBRAE (24TH, 25TH, AND 26TH) OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. NO. 7757, U.S.N.M. ½ NAT. SIZE. *s*, SPINOUS PROCESS; *t*, OSSIFIED TENDONS; *z*, ANTERIOR ZYGAPOPHYSIS.

The spinous processes have a decided backward inclination and are gradually reduced in height posteriorly, disappearing altogether on the thirty-sixth vertebra. Weak zygapophyses persist as far back as the forty-fifth. The thin anterior expansion at the base of the spinous process shown in figure 6 is present only on the first 10 caudals. The most distal caudals have short cylinderlike centra without zygapophysial articulation and with but slight expansion of the two extremities (see fig. 8).

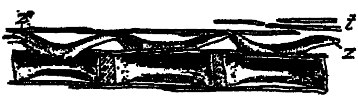

FIG. 8.—DISTAL CAUDAL VERTEBRAE (40TH, 41ST, AND 42D) OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. NO. 7757, U.S.N.M. ½ NAT. SIZE. *t*, OSSIFIED TENDONS; *z*, ANTERIOR ZYGAPOPHYSIS; *z'*, POSTERIOR ZYGAPOPHYSIS.

Chevrons.—As in *Hypsilophodon*, the chevrons are longer than the spinous processes. Their articular ends are slightly expanded anteroposteriorly, the free end flattened but without marked expansion. The first chevron is short and with a pointed distal end and rounded shaft. The two articular surfaces of the proximal end are separate. The fourth and fifth (fig. 6) are the longest of the series, but proceeding posteriorly they gradually shorten. Chevrons are known to be present as far back as the twenty-sixth caudal, but is quite likely they persist, as in many other dinosaurs, nearly to the end of the tail. The first chevron is borne on the second caudal. The fourth chevron has a length of 97 mm., the seventh measures 88 mm., the tenth 77 mm.

Principal measurements of vertebrae.

	Greatest length	Greatest width posterior end.	Greatest height with spine.		Greatest length.	Greatest width posterior end.	Greatest height with spine.
Presacrals:	*mm.*	*mm.*	*mm.*	Sacrals:	*mm.*	*mm.*	*mm.*
Sixteenth				First	41		
Fifteenth	38	29	81	Second	38		
Fourteenth	38			Third	[1] 34		
Thirteenth	37.5			Fourth	37	42	
Twelfth	37			Fifth	38		
Eleventh	37	32	85	Caudals:			
Tenth	37			First	37		
Ninth	37	35	85	Fifth	37		110
Eighth	39			Tenth	36.5		
Seventh	40			Twentieth	42		
Sixth	41	38	94	Thirtieth	38		
Fifth	41			Fortieth	28		
Fourth	42	43	107	Forty-fourth	23		
Third	42			Forty-seventh	[1] 18		
Second	42						
First	42	48	116				

Scapula and coracoid.—The scapula of *Thescelosaurus* is short, with a widely expanded upper extremity. The total length is about that of the humerus. The similar lengths of these two bones is a most unusual proportion in dinosaurian anatomy, and so far as I am aware only found in *Thescelosaurus* and *Hypsilophodon* in the Orthopoda.

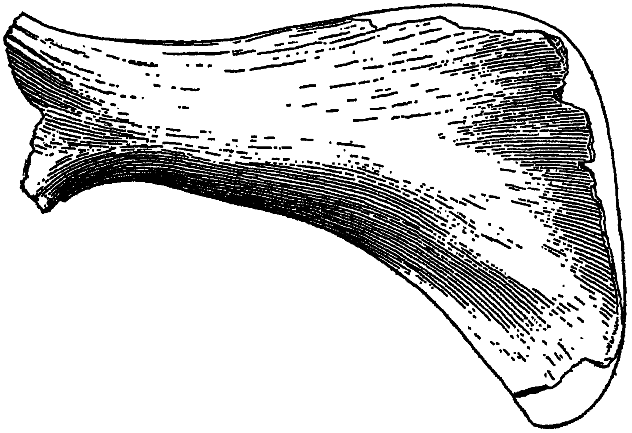

FIG 9.—LEFT SCAPULA OF THESCELOSAURUS NEGLECTUS GILMORE. PARATYPE. No. 7758, U.S.N.M. ½ NAT. SIZE. EXTERNAL VIEW.

At the time of publishing my preliminary description of *Thescelosaurus* the proximal portion of the scapula was not represented in the available material (fig. 9), but the more recent discovery among the unprepared specimens in the collections of a nearly complete scapula and coracoid (No. 7760, fig. 10) now enables me to give a full description of these elements. This specimen was collected by Mr. J. B. Hatcher in 1891, at Deer Ears Buttes, Butte County, South Dakota (see 2, fig. 20), and its occurrence there greatly extends the known geographical range of the genus.

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[1] Estimated.

Relatively the scapula of *Thescelosaurus* is short, and the backward extension of the blade is somewhat more pronounced than in either *Hypsilophodon* or *Camptosaurus*. The upper half of the blade is thin, with flattened inner and outer surfaces. The truncated and unfinished appearance of the upper margin suggests the presence of a cartilaginous extension of the blade upon the sides of the thorax, such as is present in the extinct Mosasaurs and in recent lizards.

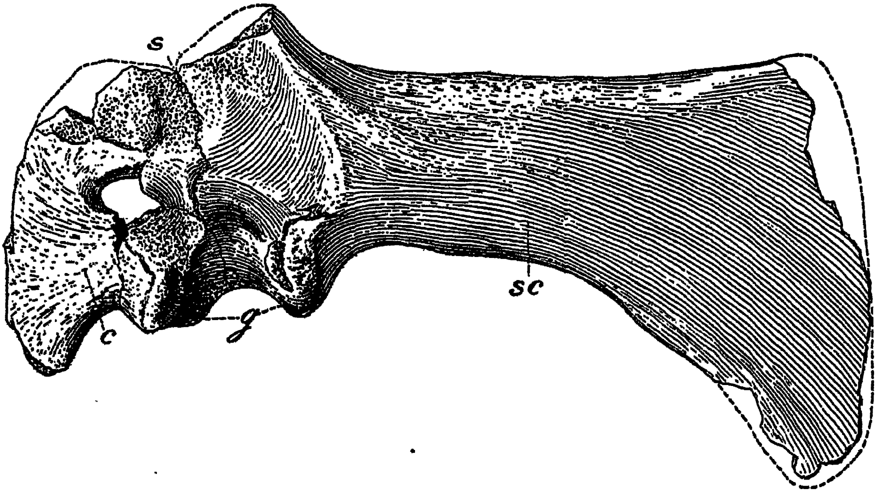

Fig. 10.—Left scapula and coracoid of Thescelosaurus neglectus Gilmore. No. 7760, U.S.N.M. ½ nat. size. Lateral view. *c*, Coracoid; *g*, glenoid cavity; *s*, suture between scapula and coracoid; *sc*, scapula.

The articulating end is expanded both vertically and transversely and presents two distinct faces or facets on the lower end, of which the longer one is for union with the coracoid, and the shorter and stouter one forms one-half of the glenoid fossa (fig. 10). On the anterior margin above the articulation for the coracoid is a short but prominent ridge that subsides rapidly upon reaching the flattened surface of the shaft. Viewed from the front the articulated scapula and coracoid is bowed from end to end and would thus conform closely to the outward curve of the body cavity. Only upper portions of the blades of the scapulae are preserved with the type-specimen, but these agree exactly with the bone here described. Compare figures 9 and 10, also plate 79.

The coracoid is a small subquadrangular plate of bone. Its glenoid border is the stoutest part, being heavier than the scapula contribution to this fossa. The internal surface is concave, the external convex. The lower border is incurved, the anterior or sternal margin is thin and regularly rounded. The coracoid foramen is placed well forward toward the center of the bone, but its large size, as shown in figure 10 is in part due to the imperfection of this part of the specimen.

Measurements of scapula and coracoid, No. 7760.

	mm.
Greatest length of scapula and coracoid	235
Greatest length of scapula	186
Greatest breadth of scapula	[1]107
Least breadth of scapula	42
Greatest expanse of glenoid cavity	35

Humerus.—None of the humeri in the United States National Museum collections are perfectly preserved, and the description to follow is based upon a right humerus (Cat. No. 5031, Amer. Mus. Nat. Hist.) kindly loaned me by Mr. Barnum Brown, of the American Museum of Natural History, New York City. It is of the same size as the distal portions of the humeri belonging to the type, and in all probability belongs to an animal of similar proportions.

The humerus of *Thescelosaurus* is indistinguishable from that of *Camptosaurus*, except that the head instead of being centrally located on the proximal end is nearer the external border. Just above the middle of the bone is a well-developed radial crest on the antero-external border and renders the anterior aspect of this surface decidedly concave transversely (fig. 11). The shaft is slightly twisted, due to the change in direction of its surfaces. Below the deltoid ridge the shaft is constricted and suboval in cross-section, the greatest diameter being transverse.

The internal border is broadly concave from end to end; the external border is convex, the curve being somewhat less than that of the opposite border. The distal end is condylarly divided, the condyles being separated by wide, shallow grooves, both front and back. The measurements of this humerus (No. 5031, Amer. Mus. Nat. Hist.) are: Greatest length, 215 mm.; greatest width, proximal end, 65 mm.; greatest width, distal end, 44 mm.; least width of shaft, 22 mm.

Ulna.—The ulna is about equally expanded at the two ends, the shaft being contracted and subcircular in cross-section at the center. As in *Camptosaurus* and *Hypsilophodon*, the olecranon does not appear to have extended much about the articular surface for the humerus. The distal end was opposed by the ulnare and intermedium elements of the carpus, as well shown in the articulated limb (fig. 11).

The greatest length of the left ulna is 154 mm., the width of the proximal end 42 mm., and width of the distal end 32 mm.

---

[1] Estimated.

Radius.—The radius is more slender than the ulna, more cylindrical, and a little shorter. Its relative proportions as compared to the ulna appear to be almost identical with the forearm of *Hypsilophodon*, except perhaps that both elements in that genus are more slender. The distal end of the radius appears to have articulated exclusively with the radiale. The length of the left radius is 149 mm.; width of proximal end, 30 mm.; width of distal end (estimated), 22 mm.

Manus.—There are five digits in the forefoot of *Thescelosaurus*. These have the phalangial formula 2, 3, 4, 3, 2, as determined from the articulated foot shown in figure 11.

The carpus consists of five elements, a proximal row of three bones of about equal proportions—the radiale, intermedium, and ulnare, and a distal row of two elements. The latter are flattened, irregularly, rounded elements that articulate with the proximal ends of metacarpals III and IV and probably represent carpalia three and four as shown in figure 11.

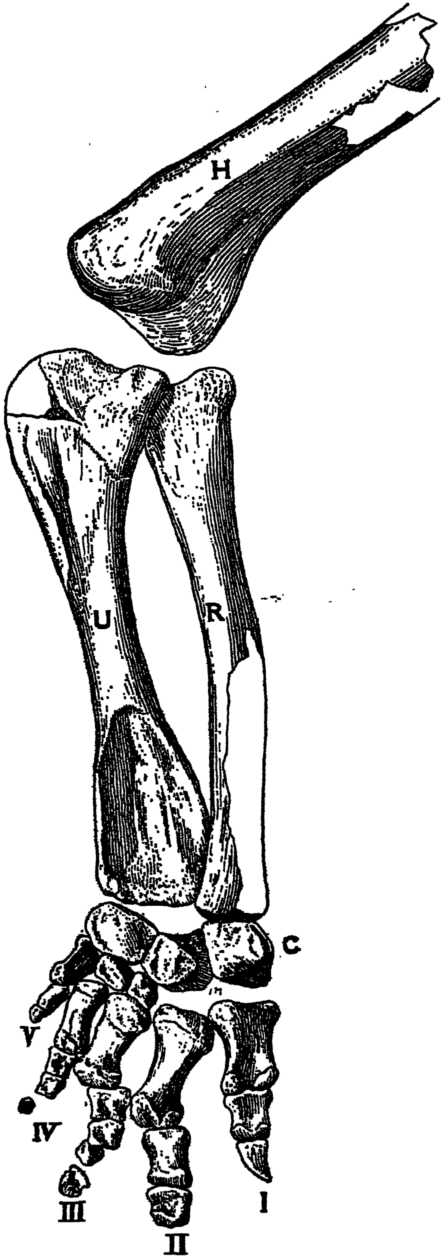

FIG. 11.—LEFT FORE LIMB OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. CAT. NO. 7757, U.S.N.M. ½ NAT. SIZE. PALMAR VIEW OF FOOT SHOWN AS FOUND IN SITU. *C*, CARPUS; *H*, HUMERUS; *R*, RADIUS; M, ULNA.

Phalangial formula of known Dinosaurian fore feet.

	Digits.				
	I.	II.	III.	IV.	V.
Thescelosaurus neglectus Gilmore...	2	3	4	3	2
Hypsilophodon foxii Huxley	2	3	4	3	2
Leptoceratops gracilis Brown	2	3	4	3	1
Camptosaurus dispar Marsh.......	2	3	3	3	2
Trachodon annectens Marsh..........	0	3	3	3	3
Iguanodon bernissartensis Boulenger..........	1	3	3	3	4

The metacarpals are much shorter than the metatarsals, the second being the longest of the series, whereas in *Camptosaurus* and *Hypsilophodon* the third is the longest. Metacarpal I is the heaviest of the five, but is more elongate than the homologous bone of the *Camptosaurus* fore foot, from which it also differs by being free from the radiale. Metacarpals III, IV, and V are progressively reduced in length, the latter articulating with the ulnare as in *Hypsilophodon.*

Digit I has two phalanges, the terminal one being a short but sharply pointed ungual. Digit II has three phalanges; the terminal is as yet unknown, but well-defined articular facets on the second phalanx, as shown in figure 11, indicates that such a bone was present in the complete foot.

The presence of four phalanges on the third digit is an unusual number and so far as I am aware only found in *Thescelosaurus* and *Hypsilophodon* among the dinosauria.[1] Of this feature in *Hypsilophodon* Hulke says:

> It is fortunate that the number of phalanges, four, in this toe (IIIrd of the manus) is beyond question, because it shows an essential structural difference between the forefoot of *Hypsilophodon* and that of *Iguanodon mantelli,* in which, upon the evidence of undisturbed specimens in the Brussels Museum, no digit has more than three phalanges.

The same may be said of the third digit of *Thescelosaurus* as compared with that of *Camptosaurus.*

The ungual of digit III is a small bluntly rounded hooflike terminal phalanx suggestive of the unguals of the primitive ceratopsian *Brachyceratops.* The terminals of digits four and five have been reduced to tiny, rounded bony nodules.

From the above figures and descriptions of the manus of *Thescelosaurus* it will be seen that the fifth digit is becoming atrophied and fast approaching a functionless condition. On account of the manus still remaining in the matrix with the palmar side up, it has not been possible to either figure or describe the opposite side.

Comparative lengths of metacarpals.

	Metacarpals.				
	I.	II.	III.	IV.	V.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Thescelosaurus neglectus	27	34	26	21	16
Hypsilophodon foxii	17	18.5	19.5	12	8
Camptosaurus dispar	26	61	76	60	40

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[1] Since the above was written a description of the new Ceratopsid reptile *Leptoceratops gracilis* Brown shows that reptile as also having four phalanges on the third digit. Bull. Amer. Mus. Nat. History, vol. 33, 1914, p. 571.

THE HIND LIMB.

The hind limb in *Thescelosaurus* is less than twice the length of the fore limb, and, as usual among the orthopodous dinosaurs, is much more robust. The tibia is slightly shorter than the femur.

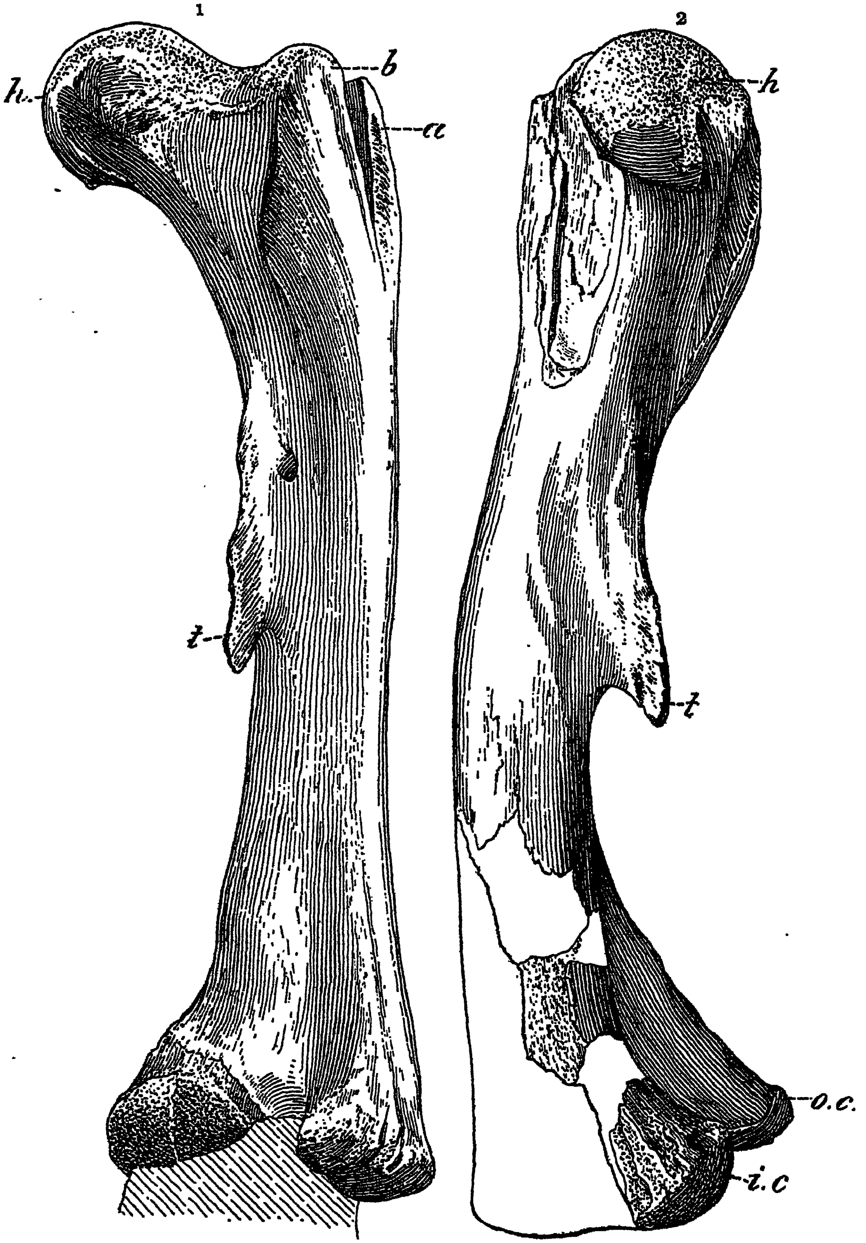

FIG. 12.—RIGHT FEMUR OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. CAT. NO. 7757, U.S.N.M. ½ NAT. SIZE. (1) BACK VIEW; (2) EXTERNAL VIEW. *a*, LESSER TROCHANTER; *b*, GREATER TROCHANTER; *h*, HEAD; *i. c.*, INTERNAL CONDYLE; *o. c.*, OUTER CONDYLE; *t*, FOURTH TROCHANTER.

Femur.—The type has both femora preserved. The femur is bowed from end to end, as in *Camptosaurus, Laosaurus,* and *Dryosaurus.* It has a subglobular head borne on a distinct neck. There is a well-developed lesser trochanter on the anterior external angle of the proximal end, being separated from the upper part of the shaft by a deep vertical fissure. On the outer posterior side of this end is a projecting liplike process not before observed on the femora of other orthopodous dinosaurs (fig. 12).

The distal end has the usual condylar shape, the outer being stronger than the inner. The anterior intercondylar groove is wide and shallow. As with the humerus, the shaft of the femur is twisted, due to the alteration of the aspects of its surfaces.

On the inner and posterior aspect of the femur is a triangular inner or fourth trochanter of the "pendant" type, its apex being directed toward the distal end. It begins above but extends below the mid-line of the shaft, as in *Camptosaurus.* In *Hypsilophodon* this process is wholly upon the proximal half.

Measurements.

	mm.
Greatest length of femur	355
Greatest diameter of proximal end	92
Greatest diameter of distal end	70

Tibia.—The tibia (fig. 13) in *Thescelosaurus* resembles that of *Camptosaurus* nearer than it does that of *Hypsilophodon.*

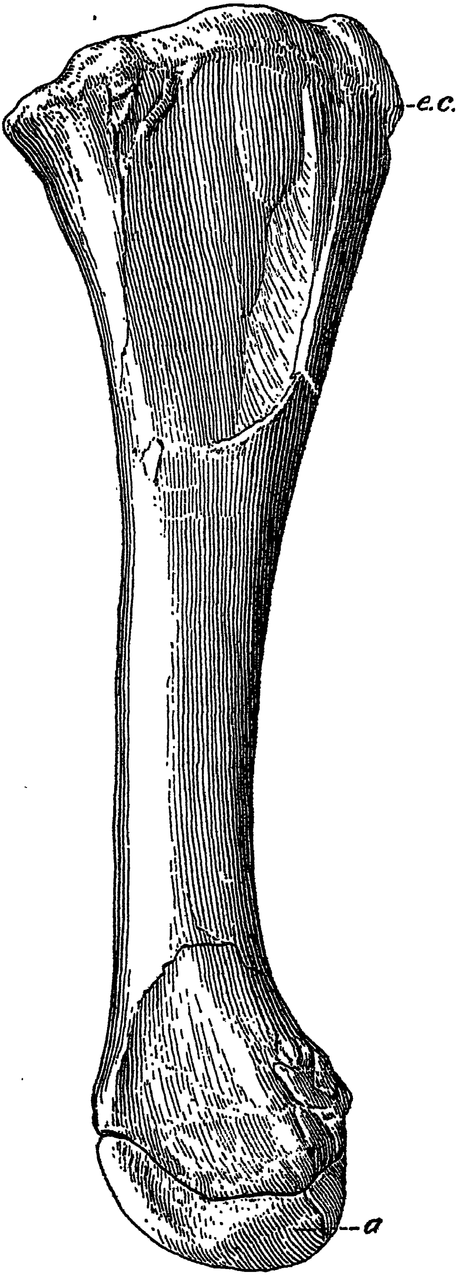

Fig. 13.—Left tibia of Thescelosaurus neglectus Gilmore. Type. Cat. No. 7757, U.S.N.M. ½ nat. size. Internal view. *a*, Astragulus; *e. c.*, enemial crest.

It is slightly shorter than the femur. The proximal end is divided into two condyles which project posteriorly and are separated by an intercondylar groove. A well-developed prenemial crest projects from the upper part of the shaft in front of the internal condyle. The distal end is divided into the two usual malleoli of which the inner is the shorter and the heavier. These are separated on the front by a shallow, vertical groove. The flattened surfaces on the lower anterior face of the bone was in contact with the distal extremities of the fibula. Transversely the distal surface of the tibia is angularly convex.

Measurements.

	mm.
Greatest length of tibia	300
Greatest diameter proximal end, antero-posteriorly	107
Greatest diameter distal end	77

Fibula.—As usual the fibula is slender and somewhat shorter than the tibia. It has a flattened shaft, above which it becomes subcylindrical, below with a flattened posterior face that lays against the opposing face of the tibia (fig. 14). It has a greatest length of 276 mm.

Pes.—In the pes of *Thescelosaurus* there are four functional digits and one (the fifth) that is vestigal. In the preliminary description of this animal it was stated, "There are four digits in the hind foot, metatarsal I being reduced; digit V is wanting." More complete preparation of the hind foot, however, disclosed a rudimentary fifth metatarsal attached to the posterior side of metatarsal IV, as shown in figure 16.

Tarsus.—The ossified tarsus is composed of four elements, the astragalus and calcaneum forming the proximal row, and two flattened blocklike bones, that articulated with the proximal ends of metatarsals III and IV to form the distal row.

The astragalus, although closely applied to the tibia, is not anchylosed with it. The calcaneum is higher than wide and articulates distally, entirely with the outer tarsal element

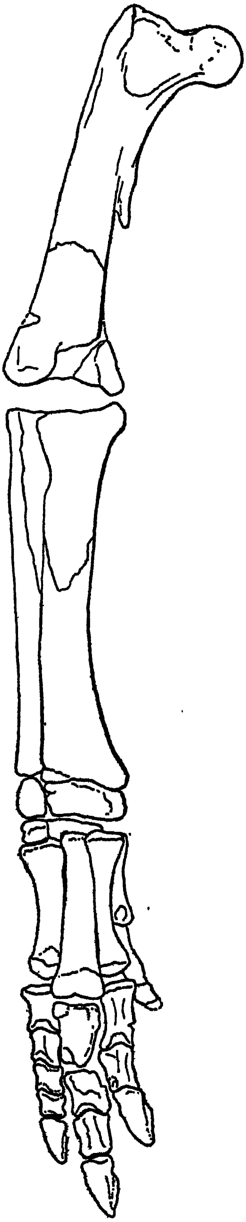

FIG. 14.—RIGHT HIND LEG OF THESCELOSAURUS NEGLECTUS. TYPE. CAT. NO. 7757, U.S.N.M. ABOUT ¼ NAT. SIZE. FRONT VIEW, SHOWN AS FOUND ARTICULATED.

of the distal row as in all other orthopodous dinosaurs. Viewed from the external side this bone is crescentic in outline.

The external tarsal of the distal row articulates with the outer half of the proximal end of metatarsal IV, while the inner element completely covers the upper end of metatarsal III and extends part way over metatarsal IV. The extension of this carpal bone over the joint between metatarsals III and IV, and its notched distal surface for the more perfect articulation with metatarsal IV is the most perfect mechanical joint yet observed in the Dinosauria. It is an advance in the specialization of the tarsus over any of the earlier known members of this group and is admirably adapted to resist the strains which come upon the foot.

Metatarsus.—The metatarsus consists of five metatarsals, of which three are large and support functional toes. Metatarsal I is reduced and metatarsal V is vestigal.

The proximal ends of the three median metatarsals are in the closest apposition, their shafts being closely applied to one another for more than half their lengths.

The proximal and distal ends of the metatarsalia II, III, and IV are stout, with deep pits for the attachment of lateral ligaments.

The relative lengths of the metatarsalia are remarkably similar to those of *Hypsilophodon* and *Camptosaurus*, as is shown in the following table:

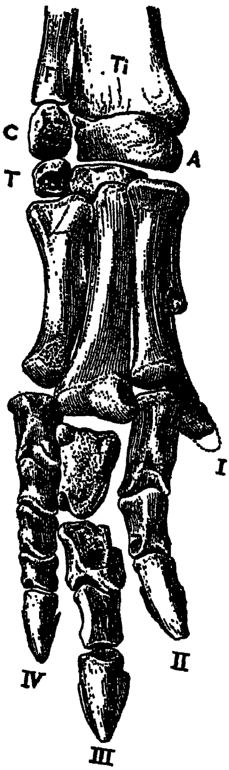

FIG. 15.—RIGHT HIND FOOT OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. CAT. NO. 7757, U.S.N.M. ¼ NAT. SIZE. SHOWN AS FOUND IN SITU. *A*, ASTRAGULUS; *C*, CALCANEUM; *F*, DISTAL END OF FIBULA; *T*, DISTAL ROW OF TARSALS; *Ti*, DISTAL END OF TIBIA; I, II, III, AND IV, DIGITS ONE TO FOUR.

	I.	II.	III.	IV.	V.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Thescelosaurus	65	112	127	106	28
Hypsilophodon	....	93	105	87.5	32
Camptosaurus	133	212	234	202	....

It will be observed that metatarsal III is the longest and heaviest. The first is about half the length of the third and the fifth is less than one-fourth the length of the same element. Digits II, III, and IV carried all of the weight. Digit I would scarcely have touched the ground, and was doubtless fast becoming functionless. It articulates rather loosely with metatarsal II, lying in a shallow depression on the inner proximal side of this metatarsal, as shown in figures 14 and 15.

Metatarsal V is shown in figure 16, and is a small flattened bone constricted at the middle, with slightly expanded ends. It probably did not support any phalanges.

Phalanges.—The digits have, respectively, two, three, four, and five phalanges, corresponding in number with most other bipedal dinosaurs. The proximal phalanx of digit I is especially elongated, as in *Brachyceratops.* The ungual of this toe is broken, but judging from the remaining proximal half it appears to have been short and bluntly pointed.

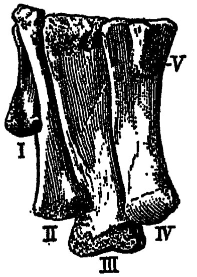

FIG. 16.—METATARSALS OF RIGHT HIND FOOT OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE, No. 7757, U.S.N.M. ½ NAT. SIZE. VIEWED FROM THE BACK, AS SHOWN AS FOUND ARTICULATED. I, II, III, IV, AND V, METATARSALS ONE TO FIVE.

The relative proportions of the remaining phalanges are remarkably similar to those of *Camptosaurus.*

Viewed from above, the phalanges have vertically concave proximal and convex distal ends. Excepting the proximal ends of the first row, all of the joints are broadly keeled, thus forming strong articulating joints, that would be proof against lateral dislocation. Well-defined pits are present for the attachment of the lateral ligaments. The ungual phalanges are curved, of moderate length, and more depressed than in *Camptosaurus.* They are relatively shorter and less sharply pointed than in *Hypsilophodon.* The lateral grooves for the external claw are well defined.

The pes of *Thescelosaurus* may be distinguished at once from the hind feet of either *Dryosaurus* or *Laosaurus* by the greater elongation of the metatarsals in those genera. In *Thescelosaurus* the greatest length of metatarsals I, II, III, and IV is less than the total lengths of the articulated phalanges of those digits. In *Hypsilophodon* this condition prevails in digits III and IV, but in digit I the metatarsal exceeds the phalanges in length, while in *Drysaurus* and *Laosaurus* the metatarsals exceed the phalanges in this measurement. In its general proportions the pes of *Thescelosaurus* resembles that of *Camptosaurus* closer than it does that of its nearest relative *Hypsilophodon.*

Measurements of hind foot of No. 7757, U.S.N.M.

	Digits.				
	I.	II.	III.	IV.	V.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Greatest length of metatarsals	65	112	127	106	28
Greatest antero-posterior diameter, proximal end of metatarsals				28	4
Greatest transverse diameter, proximal end of metatarsals				41	12
Greatest transverse diameter, distal end of metatarsals				23	11
Greatest length first row phalanges	51	53	[1] 46	35	
Greatest length second row phalanges		34	38	26	
Greatest length third row phalanges		47	35	22	
Greatest length fourth row phalanges			54	19	
Greatest length fifth row phalanges				40	

[1] Measurement from another individual (No. 7758) of same proportions.

THE PELVIC ARCH.

The pelvic arch is sufficiently diagnostic of the genus to separate *Thescelosaurus* at once from all other known dinosaurs.

The bones to be described below pertain to the type-specimen No. 7757, U.S.N.M.

Ilium.—Both ilia are present, but only the right one is available for study and it lacks a portion of the posterior end, as shown in figure 17. The ilium is elongate antero-posteriorly, and very narrow vertically. In the latter particular it is relatively narrower even than the ilium of *Camptosaurus depressus* Gilmore. The preacetabular process is long and tapering, triangular in cross-section near its middle, but flattened toward the tip, which terminates anteriorly in a sharp-pointed end.

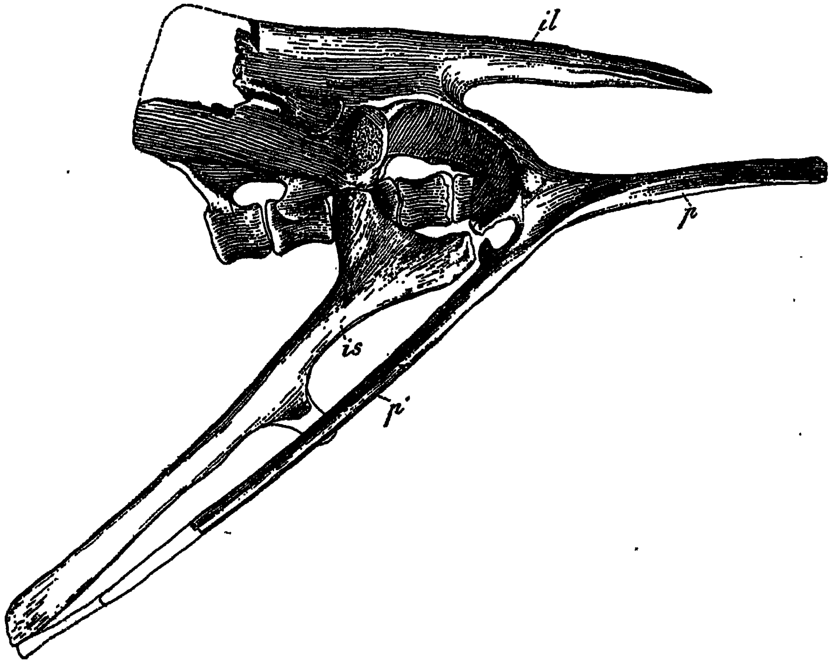

FIG. 17.—PELVIS AND SACRUM OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE. CAT. NO. 7757, U.S.N.M. ¼ NAT. SIZE. VIEWED FROM THE RIGHT SIDE. *il*, ILIUM: *is*, ISCHIUM; *p*, PREPUBIS; *p′*, POSTPUBIS. THE ILIUM IS DRAWN FROM AN OBLIQUE VIEW.

The missing posterior portion as restored in outline in figure 17, also plate 80, is after the ilium of *Camptosaurus*. On the inner side behind the acetabulum a comparatively thin but wide shelf of bone (fig. 17) is given off at right angles to the main portion of the ilium and extends inward, articulating by suture along its inner margin with the ribs of the two posterior sacral vertebrae.

The acetabular arc ends anteriorly in a broad, but relatively light pubic peduncle, being terminated posteriorly by a heavy swelling which forms the articulation for the ischium.

The external side of the ilium is slightly concave from end to end.

Measurements of ilium, No. 7757.

	mm.
Greatest length of ilium	336
Greatest length from posterior end to the center of preacetabular notch	193
Greatest width over ischiac articulation	91
Greatest width at middle of acetabulum	48
Greatest expanse of acetabulum	78

Pubis.—The prepubic portion of the pubis is an angularly rounded rodlike bone that extends forward nearly parallel with the preacetabular process of the ilium, exceeding the latter in length. The acetabular end is thick and heavy and above is closely united with the peduncle of the ilium. Below this acetabular portion is an oval foramenal notch, that in an aged individual would doubtless become closed as it has in the pubis of *Hypsilophodon.* The postpubis is a long, slender, rodlike bone that reaches the end of the ischium. It is rounded as in *Camptosaurus*, and contrasted with the postpubis of *Hypsilophodon*, it is more flattened with a somewhat heavier shaft. In the type-specimen the distal extremities of the postpubis are missing but the impression of these bones in the matrix shows their exact length and also gives a good idea of their size and rounded shape, as indicated in figure 17.

Measurements of pubis, No. 7757.

	mm.
Greatest length of prepubis	192
Greatest length of postpubis	[1] 516
Greatest width of prepubis	11
Greatest depth of prepubis	19

Ischium.—The ischium is a long, slender, somewhat flattened bone, that when articulated is directed backward and downward from the ilium. The proximal end is moderately expanded with two distinct articular ends. The anterior one which articulates with the pubis and the heavier one that meets the ischiac peduncle of the ilium is shown in figure 17. The upper concave border between these two processes forms the greater portion of the lower boundary of the acetabulum. Below the head, the shaft contracts rapidly but again widens on the infero-internal border into a thin, narrow, upturned obturator process which curves up under the slender postpubis. This process is much more elongate and placed more distally than in *Camptosaurus*, but resembles *Hypsilophodon* in both these respects.

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[1] Estimated.

Below the obturator process the ischium retains about the same width to the slightly thickened distal extremity. The inner borders of the lower third of the ischia were in contact as shown in the articulated pelvis and also by the ischium of the American Museum specimen (Cat. No. 5031, A.M.N.H.) which exhibits a flattened, thickened face for this union. The distal ends of the ischia in the type were largely missing and have been restored, but their length and shape could be quite accurately determined from the impressions remaining in the sandstone.

Ribs.—All of the known presacral vertebrae bear ribs. The four vertebrae immediately preceding the sacrum carry single-headed ribs, all others being double-headed.

In the neck, as shown by specimen No. 7758, the cervical ribs are short with the usual forked vertebral end. Their free end is rounded and pointed, and is extended antero-posteriorly.

The anterior thoracic ribs are considerably curved near the upper extremities. The shafts are moderately broad antero-posteriorly with truncated lower ends. The tubercular branch is reduced to a mere tubercle placed on the superior border where the long capitular branch joins the shaft of the rib (fig. 18). The distance between the capitulum and tuberculum gradually shortens proceeding posteriorly, until on the fourth in front of the sacrum both blend in a single articular facet which attaches to the end of the transverse process. Whether these ribs become ankylosed to the transverse process at the end as they do in *Hypsilophodon* can not be surely determined, though it is likely in an aged individual they would become firmly fastened.

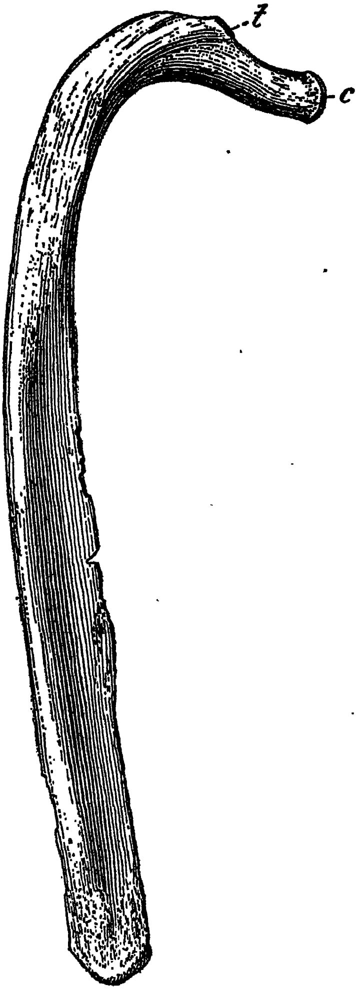

Fig. 18.—Right thoracic rib of Thescelosaurus neglectus Gilmore. Type No. 7757, U.S.N.M. ½ nat. size. Viewed from the front. *c*, Capitulum; *t*, tuberculum.

These single-headed ribs are directed decidedly forward.

The ribs posterior to the seventh in the type-specimen shorten rapidly and at the same time the shaft becomes very slender.

The first, second, third, and fourth thoracic ribs are connected with the sternum by cartilaginous ribs, as shown in figure 19. In life it is quite likely that several more may have been similarly connected.

The greatest length of the principal ribs are given in the following table of measurements:

Measurements of thoracic ribs.

	mm.
First rib preserved on the right side	265
Second rib preserved on the right side	293
Third rib preserved on the right side	295
Fourth rib preserved on the right side	280
Fifth rib preserved on the right side	269
Last rib of the series on the right side	38

The manner in which the thoracic ribs join the sternal ribs is well shown in figure 19.

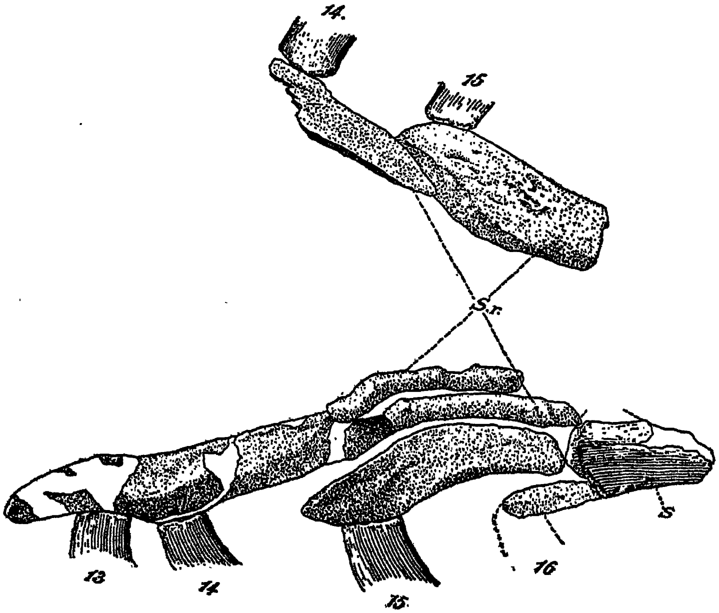

FIG. 19.—FRAGMENT OF STERNAL BONE AND STERNAL RIBS OF THESCELOSAURUS NEGLECTUS GILMORE. TYPE NO. 7757, U.S.N.M. ½ NAT. SIZE. *s*, FRAGMENT OF LEFT STERNAL BONE; *S. r.*, SACRAL RIBS; 13, 14, 15, AND 16, ENDS OF THORACIC RIBS, COUNTING FROM THE SACRUM.

Sternum.—The presence of a sternum is indicated in the type-specimen by a fragment of the posterior part of the left sternal bone retained in the matrix nearly in its proper position, and articulating with the partially ossified sternal ribs, as shown in figure 19.

The remaining portions of the sternum were weathered away before the specimen was discovered, so there is no information as to its shape and extent.

From the evidence of this specimen there were at least four thoracic ribs joined to the sternum by cartilaginous ribs. Counting from the sacrum, these ribs articulated with the thirteenth, fourteenth, fifteenth, and sixteenth presacral vertebrae.

The sternal ribs are not fully ossified, and on that account are very spongy and without well-finished surfaces.

Preservation of the epidermis.—External to the ribs and posterior to the blade of the scapula of the left side a small dark-colored area was found, which is thought to represent a portion of the carbonized epidermal covering of the animal. A second patch was found along the outer side of the anterior thoracic vertebrae, as shown in Plate 79. It presents a punctured surface, but there is no indication of a regular pattern and no evidence of dermal ossifications, though Nopcsa[1] has reported the presence of thin ossifications with the remains of *Hypsilophodon* that are regarded by him as pertaining to the skin.

POSITION OF THE SKELETON.

When the skeleton was discovered the skull, neck, and portions of the pectoral arch had been eroded away, but it appears most probable that all of these missing parts were present when the animal was first entombed. The skeleton as now exhibited (see Plate 79) lies on its left side in approximately the same position as when first discovered, with nearly all of the bones articulated. The right hind limb, when found, was disarticulated at the hip, and extended out above the sacrum at right angles to the longer axis of the skeleton. It was deemed expedient to properly articulate this leg, and this has been done, as shown in Plate 79, the original angulation of the limb and foot being preserved undisturbed. The contact for the block of matrix containing the right fore leg and foot was lost, so that it was arbitrarily placed as here shown. With these two exceptions all other parts of the skeleton are as found.

A few of the missing portions, as the ends of ribs, limb, and pelvic bones and parts of a few vertebrae, have been restored, and following the usual procedure these restored portions are painted a light color, thus making them easily distinguished from the fossil parts. At this time (November, 1915) the skull of this animal is unknown, and on that account no attempt has been made to restore it in the prepared specimen.

The position of the skeleton is that of an animal having died a natural death, for the skeleton has not been dismembered by being preyed upon. The distended ribs indicate a rapid filling of the thoracic cavity after death, and this quick covering of the entire skeleton would undoubtedly account for the excellent preservation of the specimen.

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[1] Geol. Mag., vol. 2, 1905, p. 205.

The pelvic bones are all articulated and but little distorted by crushing, though the ischia and postpubes have suffered the loss of pieces since the specimen was collected.

In the preservation of a portion of one of the sternal elements and the greater number of the sternal ribs this specimen is unique, and it contributes much to our better understanding of this portion of dinosaurian anatomy.

The importance of preserving articulated dinosaurian specimens in their original position in the matrix can not be too highly estimated, particularly where they give positive information, as in the present specimen, relating to the proper articulation and angulation of the feet and limbs. Unlike the mammals, in the dinosaurs the articular surfaces are usually poorly defined, and afford little evidence concerning the exact manner of articulation of bones found detached and misplaced. So that any information conveyed by the finding of an articulated specimen with bones in sequential position in the rock is more to be relied upon than any number of expert opinions. It was in deference to the above views that a decision was reached regarding the present manner of exhibiting this specimen of *Thescelosaurus.*

I am also of the opinion that specimens so exhibited hold the attention of the average museum visitor far longer and arouse a keener interest in the genuineness of the specimen than does a skeleton that has been freed from the rock and mounted in an upright, lifelike posture.

To the layman the type of *Thescelosaurus neglectus* as now exhibited is of interest as showing the skeleton in the same position as when covered up millions of years ago, and to the vertebrate paleontologist it will long remain a standard for interpreting and coordinating the scattered and isolated parts of others of its kind.

CLASSIFICATION AND RELATIONSHIPS OF THESCELOSAURUS.

The nonunion of the pubes in front of the sacrum, the slender postpubic processes extending parallel to the ischia, and the characteristic birdlike hind feet show *Thescelosaurus* to be a true member of the suborder Orthopoda, or Predentate dinosauria.

In the first description[1] this genus was referred provisionally to the family Camptosauridae, but after a more thorough study of the type specimens I am now convinced that its family attributes are with the Hypsilophontidae. The latest definition that I am able to find of the family Hypsilophontidae is that of Zittel,[2] which follows:

> *Prämaxillaria zahnlos.* Zähne auf den Maxillaria in einer Reihe. Vordere Wirbel platycöl oder opishocöl. Sacralwirbel verschmolzen. Femur kürzer als Tibia. Hand mit 5 Fingern, Fuss mit 4 Zehen.

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[1] Gilmore, Charles W., Smiths. Misc. Coll., vol. 61, 1913, No. 5, p. 5.

[2] Grundzüge der Palaontologie, 1911, pt. 2, p. 289.

Under the above definition were included the genera *Nanosaurus*, *Laosaurus*, and *Dryosaurus* from America and *Hypsilophodon* from the Wealden of the Isle of Wight.

Evidently it is a slip of the pen that the premaxillaries are described as being without teeth, for they were certainly present in the premaxillae of *Hypsilophodon* (the type-genus of the family), as is abundantly demonstrated by the text and illustrations of several authors.

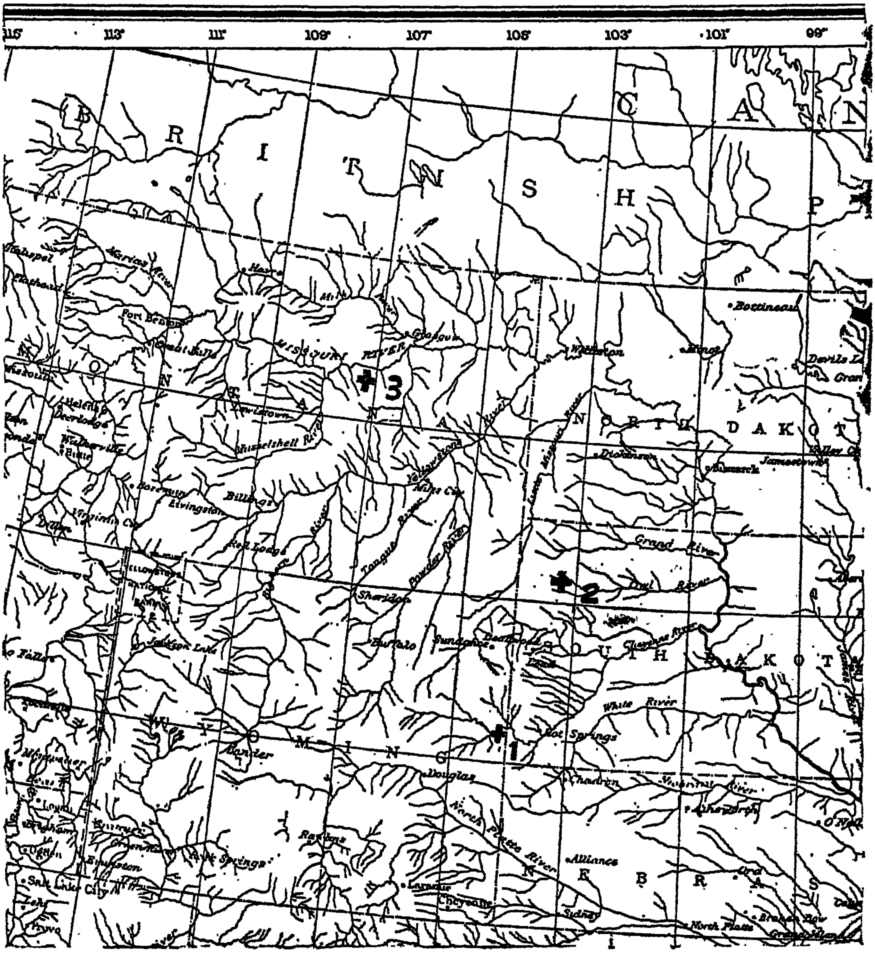


FIG. 20.—MAP SHOWING LOCALITIES WHERE THESCELOSAURUS REMAINS HAVE BEEN FOUND. (1) NIOBRARA COUNTY, WYOMING; (2) DEER EARS BUTTES, SOUTH DAKOTA; (3) HELL CREEK, IN MONTANA.

Whether *Thescelosaurus* will be found to have teeth in the premaxillaries is yet to be determined. It is quite probable, however, that during the great time interval that had elapsed between the

Wealden and the Lance, these teeth have disappeared in the somewhat more specialized *Thescelosaurus*.

The presence in *Thescelosaurus* of single-headed posterior thoracic ribs and four phalanges on digit III of the fore foot are structural features sufficient to separate it from all known dinosaurian genera with the exception of *Hypsilophodon*, and I would therefore assign *Thescelosaurus* to the family Hypsilophontidae.

The combination of characters now considered diagnostic of this family are:

Premaxillaries with teeth. Digit III of the hand with four phalanges. Femur either longer or shorter than tibia. Posterior thoracic ribs single-headed. *Genera.*—*Hypsilophodon* Huxley from the Wealden of the Isle of Wight and *Thescelosaurus* Gilmore from the Lance formation of Wyoming.

For obvious reasons the genera *Nanosaurus*, *Laosaurus*, and *Dryosaurus* should be removed to the family Laosauridae.

The genus *Thescelosaurus* may be distinguished from *Hypsilophodon* by the greater length of the femur over the tibia and by the position of the fourth trochanter below the middle of the femur, whereas in *Hypsilophodon* this trochanter is entirely upon the proximal half of that bone.

The chief similarities and differences in the skeletal structure of the two genera constituting the family Hypsilophontidae are contrasted in the parallel columns below:

Hypsilophodon.	*Thescelosaurus.*
Skull:	
Premaxillaries with teeth.	Unknown.
Maxillaries with a single row of teeth.	Unknown.
Anterior vertebrae platycoelian.	Same.
Sacrum of five vertebrae coossified.	Same.
Posterior thoracic ribs single headed.	Same.
Sternum ossified.	Same.
Scapula elongated with moderately expanded blade.	Scapula shortened with expanded blade.
Manus with five digits, metacarpals moderately lengthened.	Manus with five digits, metacarpals shortened.
Third digit with four phalanges.	Same.
Femur longer than tibia.	Femur shorter than tibia.
Fourth trochanter on proximal half of femur.	Fourth trochanter extending below middle of femur.
Pes with five digits, metatarsals elongated. Met. V vestigal.	Pes with five digits, metatarsals shortened. Met. V vestigal.
Rounded rodlike pubis with long slender postpubis.	Same.
Ischium with obturator process near center of shaft.	Ischium with obturator process nearer proximal end.
First 14 caudals with transverse proc-	First 10 caudals with transverse proc-
Pubic foramen closed.	Public foramen not closed.
Sacral ribs uniting with sacrum intervertebrally.	Sacral ribs uniting with sacrum in part intervertebrally and part direct.

At the present time the fossil remains of *Thescelosaurus* are known only from the Lance formation in three widely separated localities, as shown in the accompanying map, see figure 20. These are the Niobrara County area in Wyoming, Deer Ears Buttes in South Dakota, and the Hell Creek area in Montana.

RESTORATIONS OF THESCELOSAURUS.

The skeleton restoration here given, plate 80, is based upon the type-specimen of *Thescelosaurus neglectus*. The reptile is represented about one-twelfth natural size. The pose was determined after a careful study of the type-specimen and other allied forms, and it is therefore believed to be an attitude often assumed by the animal during life. When alive this animal was about 10 feet in length and 4 feet high in the position here represented. The shaded portions show bones that are present in the type or other supplementary specimens. The missing parts are restored in outline, the neck and skull being drawn after *Hypsilophodon foxii*, its nearest relative, with slight modifications of the cervical ribs. See plate 82.

The complete presacral region is indicated as consisting of 25 vertebrae, 16 being regarded as dorsal and 9 as cervical. This number is probably not far from the correct vertebral formula, and is the same as found in two species of *Camptosaurus*. It at least gives the skeleton the form of a compact, well-balanced animal. In life this reptile was evidently strong and agile in movement. The tail was long, equaling one-half the entire length of the skeleton and doubtless served as a balancing organ when the upright bipedal posture was assumed. The dorsal, sacral, and caudal regions throughout their entire length were strengthened by a series of ossified tendons.

In plate 81 is shown a life restoration modeled by the author and based upon the type-skeleton, and it will perhaps give a more graphic idea of the life appearance of the animal than could be obtained from the articulated skeleton. In preparing the restoration an attempt was made to express the light, agile nature of *Thescelosaurus* as is so clearly indicated by the skeleton and especially by the cusorial structure of the hind limbs.

EXPLANATION OF PLATES.

PLATE 79.

View of the upper or right side of the skeleton of *Thescelosaurus neglectus* Gilmore. Type, Cat. No. 7757, U.S.N.M., about one-twelfth natural size. Shows the bones of the skeleton in nearly the position they occupied when found and as now exhibited.

The nonshaded portions represent restored parts. Page 611.

PLATE 80.

Restoration of the skeleton of *Thescelosaurus neglectus* Gilmore. About one-twelfth natural size. Based upon the type-specimen, with head and neck restored from

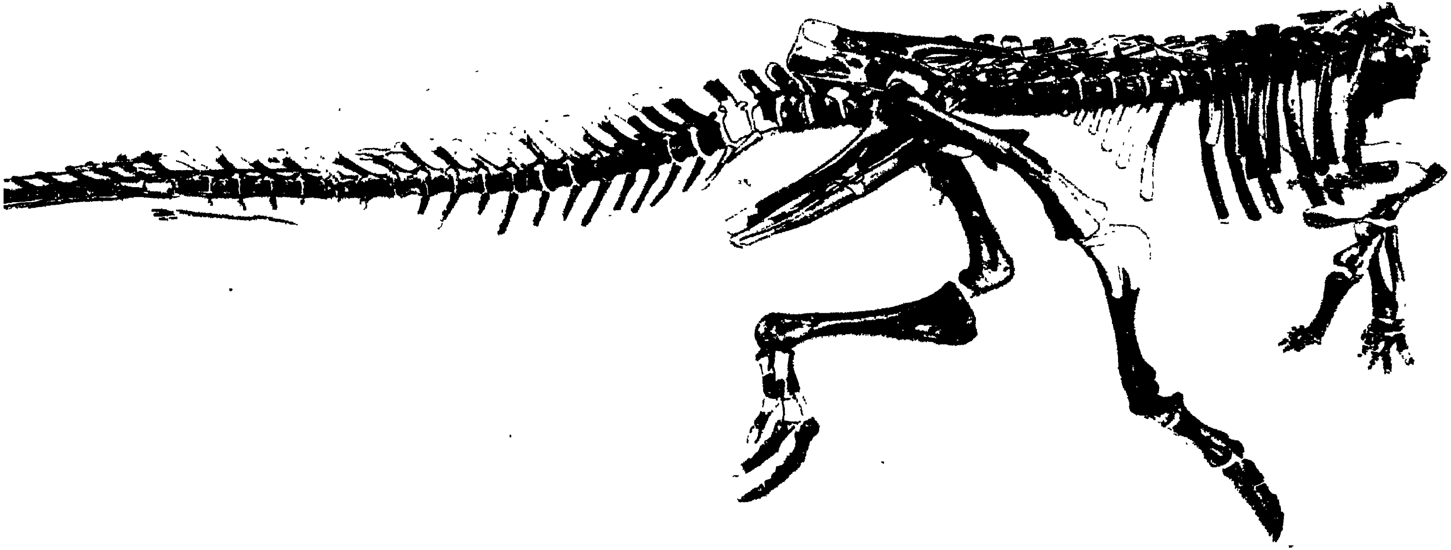
Hypsilophodon foxii Huxley. Original bones present are represented by line shading, while those parts restored are left in outline. Page 615.

PLATE 81.

Life restoration of *Thescelosaurus neglectus* Gilmore. About one-twelfth natural size. Modeled by Charles W. Gilmore. Page 615.

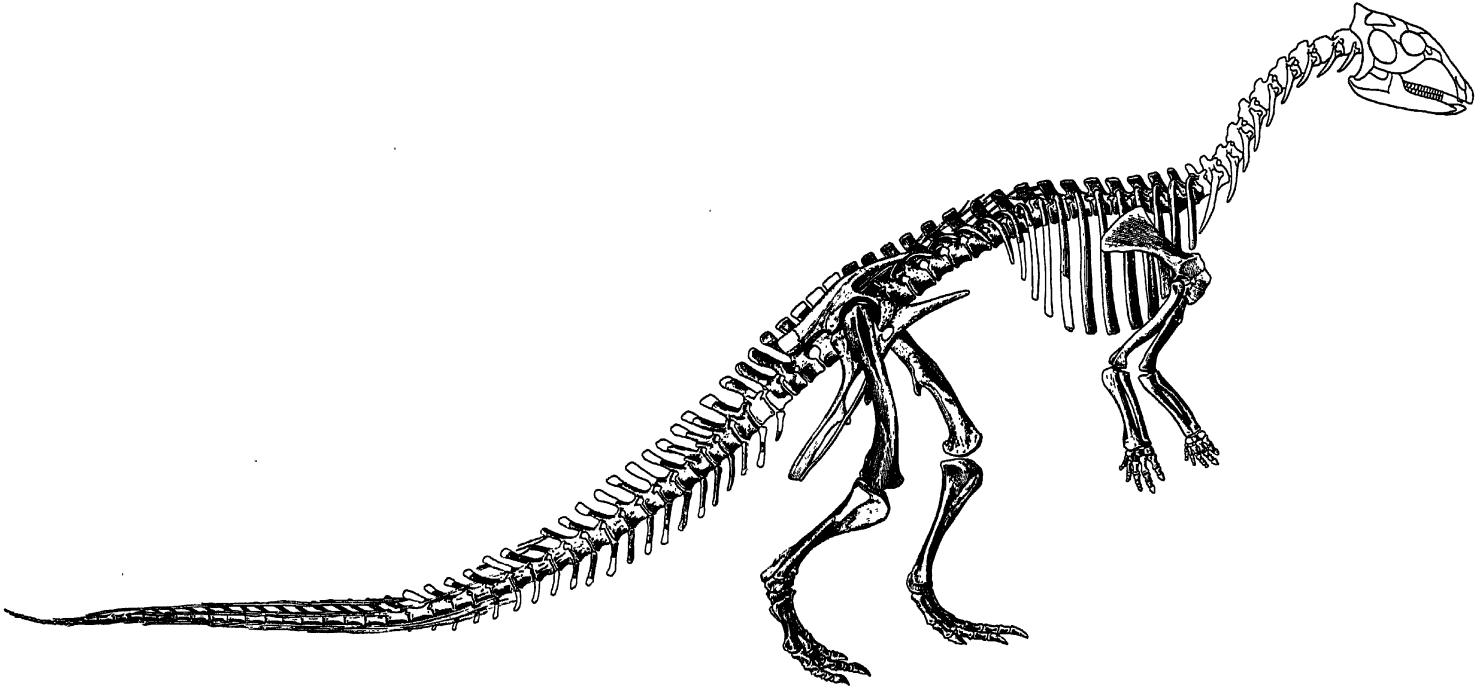
PLATE 82.

Restoration of the skeleton of *Hypsilophodon foxii* Huxley. About one-seventh natural size. After Marsh. Page 615.



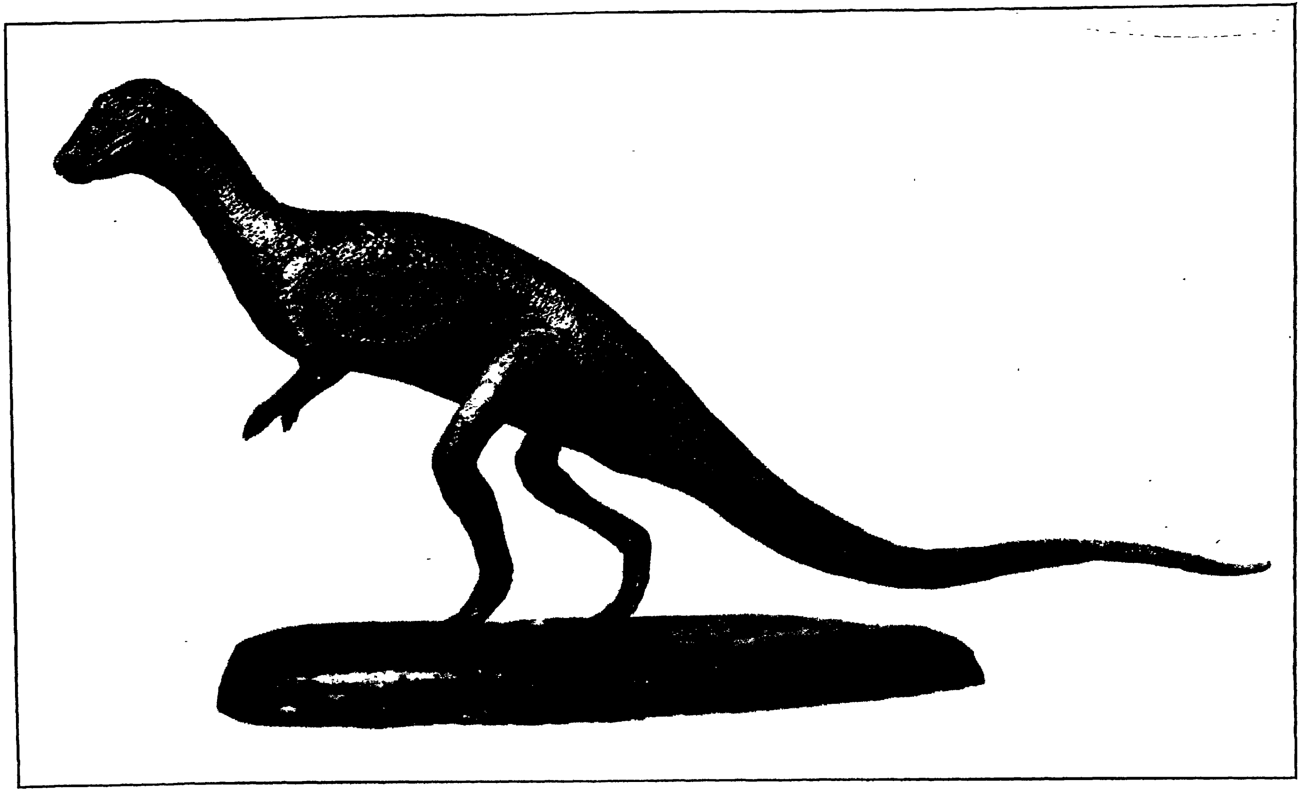
RIGHT SIDE OF THE SKELETON OF THESCELOSAURUS NEGLECTUS.

FOR EXPLANATION OF PLATE SEE PAGE 615.



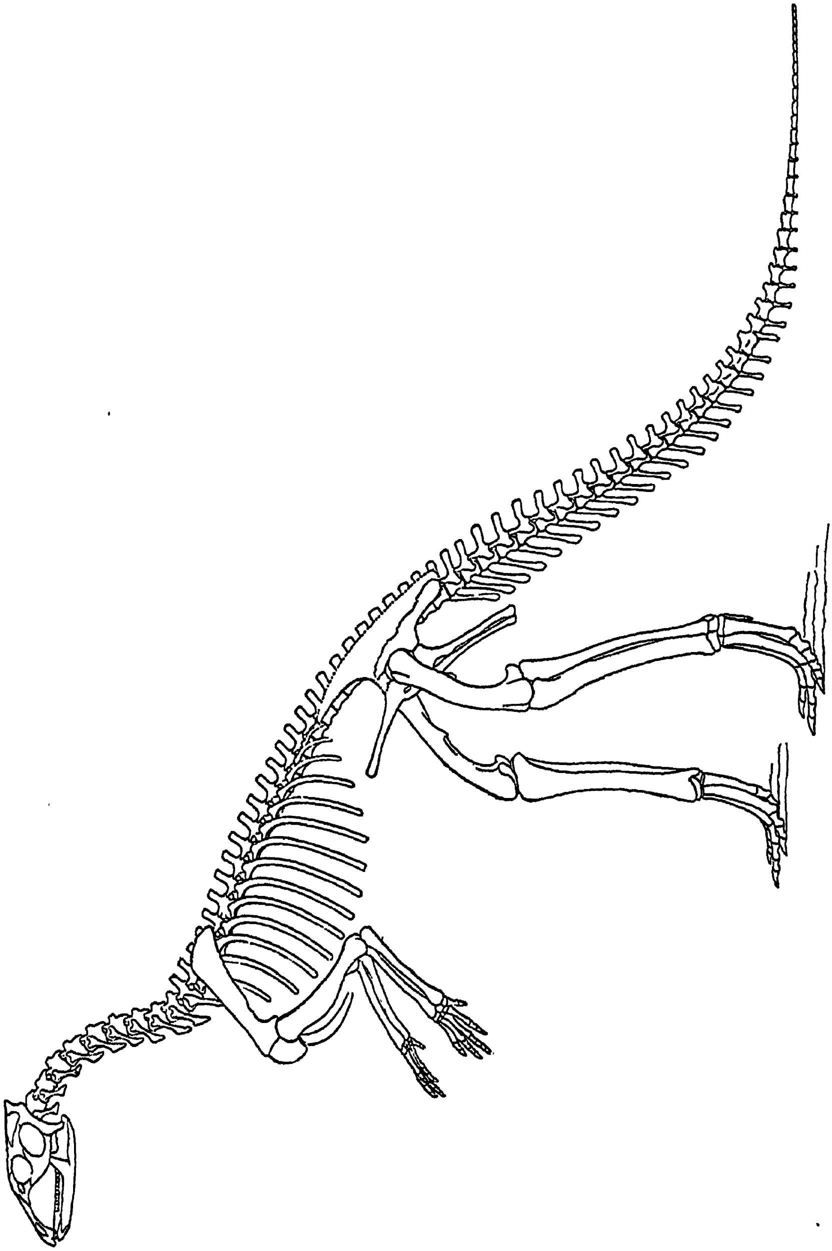
RESTORATION OF THE SKELETON OF THESCELOSAURUS NEGLECTUS.

FOR EXPLANATION OF PLATE SEE PAGE 615.



RESTORATION OF THESCELOSAURUS NEGLECTUS.

FOR EXPLANATION OF PLATE SEE PAGE 616.



RESTORATION OF THE SKELETON OF HYPSILOPHODON FOXII.

FOR EXPLANATION OF PLATE SEE PAGE 616.

DIAGNOSES OF NEW GENERA OF MUSCOID FLIES FOUNDED ON OLD SPECIES.

By Charles H. T. Townsend,

Custodian of Muscoid Diptera, United States National Museum

During the past year, the work of establishing necessary genera for the reception of already-erected species, contained in the muscoid [illegible] of the United States National Museum, has been prose[illegible] the writer. A first set of these new genera, hitherto [illegible] overlooked by students of the superfamily, or not recognized as of generic rank, and thus ignored, was recently published.[1] The present paper is in continuation of this work.

Numbers preceded by the letters TD refer to the Townsend-Dissection series.[2]

The abbreviation "Rev. Tach." is used for Mr. Coquillett's best-known work on this group.[3]

Family HYPODERMATIDAE.

ATELECEPHALA, new genus.

Genotype.—*Hypoderma diana* Brauer, Verh. Zool.-Bot. Ges. Wien, vol. 8, 1858, pp. 397, 407–478, 455, fig. 5, pls. 10 and 11; Monogr. Oestr., 1863, p. 113.

Differs from *Hypoderma* as follows: Form in general more narrowed. Front of male at vertex only two-thirds as wide as eye. Carina of second antennal joint completely covering the third joint, arista practically apical. Clypeal swelling very convex, clypeal beard very thin. Scutellum heavily tuberculate on margin. Abdomen of male laterally compressed apically, male genitalia of a distinct type.

The *Hypoderma* group is abundantly entitled to family rank. It seems in some measure allied with the cypseloid (borboroid) stock, as indicated by the auxiliary vein being much approximated to the first vein; and especially by the facial plate being greatly widened and swollen below, the facialia having become vestigial. The facial specialization consists in an extraordinary inflation of the clypeus below the foveae, forming a large subrectangular area whose edges are even with the parafacialia and cheeks. The nearly obsolete facialia are marked by sutures.

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[1] Proposal of new muscoid genera for old species, Proc. Biol. Soc. Wash., vol. 28, 1915, pp. 19-23.

[2] Explained in Proc. U. S. Nat. Mus., vol. 43, p. 301.

[3] Revision of the Tachinidae of America north of Mexico, Technical Series, No. 7, U. S. Department of Agriculture, Division of Entomology, Washington, 1897.

Family MUSCIDAE.

MICROCALLIPHORA, new genus.

Genotype.—Lucilia varipes Macquart, Dipt. Exot. Suppl., vol. 4 (2), 1851, p. 222, fig. 4, pl. 23.

A very small Australian form which may be distinguished from *Musca, Lucilia,* and related genera by the following characters: Vibrissae inserted on oral margin, otherwise much like *Chrysomya.* Parafacials pubescent. Arista practically bare on lower side. Epistoma not so prominent as in *Musca.*

Family RUTILIIDAE.

EUAMPHIBOLIA, new genus.

Genotype.—Rutilia fulvipes Guerin-Meneville, Revue Zool., vol. 6, 1843, p. 273.

Differs from *Amphibolia* as follows: Macrochaetae of abdomen heavy spinelike. Anal segment emarginate in both sexes, buttockslike. Spines on venter, pectus, and coxae. Transverse marginal row of mesoscutal spines in front of scutellum; latter pectinate with equal long marginal bristles, none of them decussate. About 10 closely-placed median marginal macrochaetae on second abdominal segment, the inner ones shortened; similar patch on third segment, marginal ones on each side making a subcontinuous row slightly marked off from the median patch; anal segment with a median bunch of six on disk, buttocks with bunches of heavy short ones, the segment with long hairs posteriorly and shorter thick pile anteriorly.

The genus may be distinguished at once from *Formosia* by the bare arista.

Family MILTOGRAMMIDAE.

MICROSENOTAINIA, new genus.

Genotype.—Senotainia nana Coquillett, Rev. Tach., 1897, p. 81.

Differs from *Senotainia* as follows: Abdomen of male subcylindrical, arched apically, hypopygial hook elongate. Male abdomen practically without macrochaetae, only some vestigial ones showing on very close examination. Front of male strongly flattened, the parafrontals closely approximated over frontalia. The edges of the narrow frontalia are indicated by the frontal bristle rows. Claws of male elongate, rather longer than last tarsal joint.

For purposes of comparison it may be stated that in *Senotainia* the parafrontals are closely approximated in female, not so in male;

abdomen is oval, and hypopygial hook of male is short, while front is scarcely flattened.

Miltogramma decisa Townsend[1] represents subgenus B of this genus, the abdomen of male being slightly swollen. *Miltogramma nana* Wulp, from Guerrero, Mexico, probably does not belong to this genus.

PARAMETOPIA, new genus.

Genotype.—Parametopia morrisoni Townsend, new species, for *Metopia leucocephala* Coquillett, Rev. Tach., 1897, p. 127, part (not *Musca leucocephala* Rossi, Fauna Etr., vol. 2, 1790, p. 306), holotype being specimen from White Hountains, New Hampshire (Morrison), labeled by Coquillett *Metopia lateralis* Macquart (not *Degeeria lateralis* Macquart, Dipt. Exot. Suppl., vol. 3, 1847, p. 208). Named in honor of H. K. Morrison. Holotype, No. 19152, U.S.N.M., female.

Both sexes with parafrontals and frontalia much as in female of *Metopia*, with other characters in general of *Metopia*. No median macrochaetae on first abdominal segment in either sex. A median marginal pair on second and third segments, the third segment without continuous marginal row. Differs from *Anicia* Robineau Desvoidy (1863) by lacking the marginal row of third segment and the median marginal pair of first segment in both sexes.

NASONIMYIA, new genus.

Genotype.—Heteropterina nasoni Coquillett, Ent. News, vol. 6, 1895, p. 207.

Differs from *Heteropterina* as follows: Cheeks not over one-fifth eye-height. Vibrissae strong, decussate, not long, inserted nearly on oral margin. Parafacials narrow, nearly equilateral, not bulged in profile, hair-rows vestigial or absent. Third antennal joint hardly twice as long as second. Arista well thickened on basal fourth or more. Costal spine pronounced. Male with two pairs of proclinate fronto-orbitals. Hypopygium of male hooklike.

The genus is named in honor of Dr. W. A. Nason.

Family SALMACIIDAE.

PATELLOA, new genus.

Genotype.—Phorocera leucaniae Coquillett, Rev. Tach., 1897, p. 104.

Allied to *Phorocera* and *Ctenophorocera*. Description is of female only. Eyes thickly hairy. Facialia strongly ciliate to lowest frontals. Vibrissae inserted on level with middle of the cut-off oral margin. Face receding, length of head at vibrissae only a little over half that at antennae. Arista thickened on less than basal third, first two joints short. Front anteriorly about one and one-third times eye-

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[1] Ent. News, vol. 3, 1892, p. 81.

width. Two proclinate outer fronto-orbitals, two reclinate inner ones, a pair of proclinate ocellars; these all about same strength. Two verticals, the inner much longer and not decussate. Proboscis short and fleshy, palpi strongly clavate. Frontals reaching halfway or less to ocellar area, descending to insertion of arista. Second antennal joint slightly elongate; third joint long, about three times as long as the second. Cheeks about one-fourth eye-height. Front tarsi of female not differentiated. Hind tibiae of female sparsely pectinate, with longer bristles. Apical cell open well but not far before wingtip. Fourth vein bent abruptly, without stump or wrinkle. Hind cross-vein sinuate, nearer to cubitus. Costal spine small. Scutellum with rather long decussate apical pair of bristles, two long strong lateral pairs, a lateral one between last and a discal separated pair about equal to apical. Abdomen with median marginal pair on segments one and two; more or less complete marginal row on three, with sometimes a median short discal pair; discal row on four besides terminal bristles. Abdomen swollen, almost oval, nearly as deep as wide, thus rather keg-shaped, anal segment subconical, reproductive slit very long, ovipositor more or less concealed within base of same. Three, abnormally four, sternopleurals; three postsuturals. Whole form stout, legs stout and not elongate, claws of female nearly as long as last tarsal joint. Wings extending a little beyond tip of abdomen. Clypeus sunken.

Uterus short and stout. The black microtype eggs are patelliform, longitudinally-concentrically corrugated.

EUGAEDIOPSIS, new genus.

Genotype.—*Gaediopsis ocellaris* Coquillett, Proc. U. S. Nat. Mus., vol. 25, 1902, p. 118.

Differs from *Gaediopsis* as follows: No facio-orbitals, only fine hairs on parafacials. No ocellars. Facial cilia of equal strength. Cheeks of male about one-third eye-height. Third antennal joint of male about three times as long as the rather elongate second. Arista as described for *Gaediopsis*. Three postacrostichals and four postsuturals.

CHAETOGAEDIOPSIS, new genus.

Genotype.—*Gaediopsis cockerellii* Coquillett, Proc. U. S. Nat. Mus., vol. 25, 1902, p. 117.

Differs from *Gaediopsis* as follows: Cilia of facialia of equal strength. Parafacials with vertical row of stronger bristly hairs in front of the finely-hairy area. Cheeks of male nearly one-half eye-height. Male with two rows of frontal bristles. Hind tibiae of male ciliate, with a long bristle in middle. Third antennal joint of male four or five times as long as wide, less than three times the elongate second. Second aristal joint over four times as long as wide, the third gradually narrowing beyond middle. The intermediate abdominal segments have discals that are a little stronger than the closely-set bristles covering the surface. The latter are a beginning stage of the densely-set spines of abdomen in other forms. Cubitus without wrinkle or stump. No facio-orbitals. Three postacrostichals and four postsuturals. Four strong lateral scutellar bristles. Abdomen thickly hairy, also pleurae and parafrontals.

EUGAEDIA, new genus.

Genotype.—*Gaediopsis setosa* Coquillett, Rev. Tach., 1897, p. 136.

Differs from *Gaediopsis* as follows: Row of long strong bristles on middle of parafacials. No ocellars. Facial cilia of equal strength. Cheeks of male about two-fifths eye-height. Antennae and arista about as in *Chaetogaediopsis*. Short discals on second and third abdominal segments. No definite wrinkle at cubitus. Three postacrostichals and four postsuturals. Pleurae rather thickly hairy. Hairs of abdomen not long, normal.

OEDEMATOCERA, new genus.

Genotype.—*Hypostena flaveola* Coquillett, Rev. Tach., 1897, p. 61.

A remarkable form approaching *Hypertrophocera* in the heavily enlarged third antennal joint of male. Proboscis is much reduced, short; palpi small; mouth evidently subatrophied. Facial plate greatly enlarged; facial depression very deep in male, the facialia and parafacials forming sharp ridges. Wings short and broad. Discal macrochaetae on second and third abdominal segments. The genus possesses the facies of *Leskia*, and may be distinguished therefrom by the above characters. The eggs are microtype, and the reproductive characters are distinctly Salmaciid. (TD 4463.)

PHYLLOPHOROCERA, new genus.

Genotype.—*Phorocera sternalis* Coquillett, Proc. U. S. Nat. Mus., vol. 25, 1902, pp. 111–112.

Differs from the genotype of *Phorocera* (*assimilis* Fallen) as follows:

Male.—Front at vertex fully one-third head-width, frontal bristles in double row, frontalia broader behind, all the bristles of front stout; cilia of facialia stronger and less closely placed, parafacials much narrowed below, facial depression broadened in comparison with facial width, the cheeks not over one-fourth eye-height; second antennal joint scarcely elongate, the third enlarged and strongly convex in profile on upper edge; arista thickened on basal three-fifths, abruptly thin thereafter; palpi much thickened apically. Four sternopleurals and four postsuturals; thoracic and abdominal macrochaetae stronger and shorter, not mixed with long hair on the abdomen but with many short bristles and some hair ventrally.

Abdomen oval, hypopygium comparatively small; wings short, apical cell not so elongate, cubitus and hind crossvein nearer to margin.

MURDOCKIANA, new genus.

Genotype.—Euphorocera gelida Coquillett, Rev. Tach., 1897, p. 101.

Differs from *Euphorocera* as follows:

Female.—Front not widening as rapidly as the face, the frontalia nearly as wide as one parafrontal; eyes more thickly hairy; outer vertical bristle nearly as long as inner, strongly curved outward; epistoma characteristically nasute, projecting strongly between the vibrissae; palpi more slender; cheeks much broader, over two-fifths of eye-height. Four lateral scutellar bristles and a separated discal pair. Abdomen hairy, with erect discal and marginal bristles; anal segment thickly set with same, especially below. Costal spine long. Apical cell closed, not so elongate; hind crossvein not so sinuate. Third vein bristled halfway or less to small crossvein.

Male.—Compared with *Euphorocera* male, the front is conspicuously hairy and proportionately broader, the frontalia broader behind, eyes thickly hairy, cheeks well over one-half eye-height, third antennal joint much enlarged and the second comparatively shortened, hypopygium smaller, abdomen ovo-elliptical, the claws not nearly so elongate, and the other characters as described above for the female, except that there are only three lateral scutellars and the disk of scutellum bears many hairlike bristles.

The genotype is from Point Barrow, Alaska, collected by Mr. John Murdock, in honor of whom the genus is named.

Family CROCUTIDAE.

PSEUDOSIPHONA, new genus.

Genotype.—Siphona brevirostris Coquillett, Rev. Tach., 1897, p. 76.

Very distinct from *Siphona,* differing in possessing a short fleshy biflexed proboscis, the second flexure being constituted simply by a prolongation backward of labella which are folded on tip of proboscis. Form of body shortened and broadened. Second aristal joint short, or but slightly elongate.

SIPHONOPSIS, new genus.

Genotype.—Siphona plusiae Coquillett, Can. Ent., 1895, p. 125.

Labellar prolongation much greater than in *Pseudosiphona,* but fleshy rather than bristlelike, and thus not at all of the character of *Siphona.* The second aristal joint is elongate. Arista practically bare instead of pubescent. Palpi small, slender, instead of clubbed. Third antennal joint acute on upper apical corner instead of rounded apically.

PHYLACTEROPODA, new genus.

Genotype.—*Clausicella tarsalis* Coquillett, Journ. N. Y. Ent. Soc., vol. 3, 1895, p. 56.

Differs from *Clausicella* as follows: Last joint of front tarsi of female greatly elongated, widened, and flattened, longer than the front metatarsus. Third antennal joint of female three to four times as long as second, slightly widening toward apex; that of male considerably broadened, convex on under edge in profile, about three and one-half times as long as second. Face below about twice as wide as one eye. Parafacials very narrow, quite level with the facialia and facial depression in female; linear in male, the facial depression a little sunken. Cheeks of female nearly two-fifths eye-height, those of male less than one-third same. Female front anteriorly nearly or quite three-sevenths of head-width; male front a little narrower, both anteriorly and at vertex. Apical cell narrowly open, or practically closed. First vein ending but slightly outside point opposite to small crossvein, not unusually removed from auxiliary vein. Second aristal joint over one-third to nearly one-half as long as the last joint. Male with a pair of median marginal bristles on first segment, female without. Vibrissal axis of head noticeably less than antennal axis. Marginal row of weak appressed bristles on first two segments, differentiated from the short microchaetae of the general surface.

NEPHOPTEROPSIS, new genus.

Genotype.—*Clausicella johnsoni* Coquillett, Rev. Tach., 1897, pp. 55–56.

Differs from *Phylacteropoda* as follows:

Female.—Last front tarsal joint only about half as long as front metatarsus, only slightly widened and flattened. Face not so wide, about one and one-half times one eye. Cheeks hardly one-third eye-height. Body more narrowed. Wings narrower. Hind crossvein nearer to small crossvein, apical cell very narrow. Abdomen burnished metallic violet, thorax and scutellum very densely pollinose. Legs slender, especially the tarsi. Wings clouded.

LOPHOSIOCERA, new genus.

Genotype.—*Lophosiocera curriei* Townsend, new species, for *Clausicella setigera* Coquillett, Rev. Tach., 1897, p. 56, part (not *Lophosia setigera* Thomson, Dipt. Eugenies Resa, 1868, p. 527), holotype being specimen labeled Owl Creek Mountains, Wyoming, taken August 29, 1896, by R. P. Currie, in whose honor the species is named. Holotype No. 19623, U.S.N.M., male.

Differs from *Clausicella* as follows:

Male.—Cheeks hardly over one-fourth eye-height. Third antennal joint subtriangular in profile, greatly widened distally, its apical greater than its upper and about equal to its under profile, the apical edge rather evenly rounded. Apical cell very narrowly open, ending in wing-tip. Vibrissal axis of head distinctly shorter than antennal axis. Arista short, second and third joints equal. Hind crossvein nearer to small crossvein. Vertex much wider than one eye, ocellar area occupying one-half length of front. All macrochaetae weak. Abdomen short, ovoconical, rounded at tip, hypopygium large. Face over twice as wide as one eye, parafacials linear, facial depression only slightly sunken.

EUTHRYPTOCERA, new genus.

Genotype.—*Tachina latifrons* Meigen, Syst. Beschr., vol. 4, 1824, p. 365. No. 217.

This is Brauer and Bergenstamm's sense of *Thryptocera.* The genotype of *Thryptocera* Macquart [1] is hereby designated as *Thryptocera bicolor* Macquart (not Meigen).[2] For characterization of *Euthryptocera,* see Brauer and Bergenstamm, Denkschr. Akad. Wien, vol. 56, 1889, p. 102, fig. 84, and vol. 60, 1893, p. 150, under *Thryptocera* Brauer and Bergenstamm.

CHAETOSTIGMOPTERA, new genus.

Genotype.—*Chaetophleps crassinervis* Walton, Ent. News, vol. 24, 1913, p. 51.

Differs from *Chaetophleps* as follows: Parafacials linear. Epistoma very prominent, projecting. Cheeks over one-fourth eye-height. Facialia bare. Antennae shorter, third joint bulged on lower border and only three and one-half times second. Arista not so incrassate, more pubescent. Female without piercer or ventral carina. No discal bristles on abdomen. Apical cell narrowly open, or nearly closed, ending slightly behind extreme wingtip. Fourth vein merely bent in even gentle curve. Hind crossvein about in middle between cubitus and small crossvein. First vein incrassate distally, the incrassation bristled. Claws microscopic in both sexes.

The holotype is a male. Three females, from Maryland, show the wing stigma fuscous.

SLOSSONAEMYIA, new genus.

Genotype.—*Chaetophleps rostrata* Coquillett, Can. Ent., vol. 30, 1898, p. 235.

Differs from *Chaetostigmoptera* as follows: Wings narrower. First vein not thickened distally. Apical cell well open. Hind crossvein nearer to small crossvein. Third antennal joint rather narrow, about three times second. Proboscis beyond geniculation rather longer than head-height, curved strongly backward and upward at tip, subfleshy but pointed apically.

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[1] Soc. Sci. Lille, 1834, p. 310.

[2] Soc. Sci. Lille, 1834, p. 312.

The genus is named in honor of Mrs. Annie Trumbull Slosson.

EUCHAETOPHLEPS, new genus.

Genotype.—*Chaetophleps polita* Coquillett, Proc. U. S. Nat. Mus., vol. 25, 1902, p. 107.

Differs from *Chaetophleps* as follows: No proclinate fronto-orbitals in male. Male front averaging no broader than one eye, very slightly widening anteriorly, the face widening in same proportion. Parafacials gradually narrowing below. Cheeks of male hardly one-sixth eye-height. Apical cell narrowly open. Female unknown.

UROPHYLLOPSIS, new genus.

Genotype.—*Admontia retiniae* Coquillett, Rev. Tach., 1897, p. 54.

Differs from *Admontia* as follows: Facialia not ciliate. Parafacials not broad, with practically only one row of very fine hairs, latter often vestigial. Cheeks of female hardly over one-fourth eye-height. Third antennal joint of female about three times as long as second. Arista thickened on basal third. Basal aristal joints extremely short, hardly distinguishable. Front tarsi of female not widened. Apical cell closed in margin a little before wingtip.

TORTRICIOPHAGA, new genus.

Genotype.—*Pseudomyothyria tortricis* Coquillett, Journ. N. Y. Ent. Soc., vol. 3, 1895, p. 55; referred to *Hypostena*, Rev. Tach., 1897, p. 60.

Differs from *Urophyllopsis* as follows:

Female.—Front at vertex more than one-third head-width. Parafrontals wider, parafacials bare, facialia ciliate; third antennal joint about two and one-half times second, arista thickened on nearly basal half. Four sternopleurals, four postsuturals. Abdomen broad-ovate, without median marginal pair of bristles on first segment; third segment with marginal row of 10 above, rather removed from margin; anal segment with discal row of 10 and marginal row of 4 or 5; all the macrochaetae erect and rather short. Apical cell with petiole about two-fifths as long as hind crossvein, latter almost in middle between cubitus and small crossvein.

PHYTOADMONTIA, new genus.

Genotype.—*Admontia setigera* Coquillett, Invert. Pacif. (Claremont, California) vol. 1, 1904, p. 36.

Differs from *Admontia* as follows: Facialia bare. Second aristal joint not elongate. Parafacials not broad, with row of strong facio-orbitals appearing as continuation of frontals. Cheeks of female nearly one-half eye-height. Front tarsi of female modified, laterally compressed. Third antennal joint of female about three and one-half times second. Arista thickened on basal third or so. No discal bristles on intermediate abdominal segments. Apical cell narrowly open, ending a little before wingtip. Costal spine well developed.

Family MINTHOIDAE.

UROMACQUARTIA, new genus.

Genotype.—*Uromacquartia halisidotae* Townsend, new species, for *Macquartia pristis* Coquillett, Rev. Tach., 1897, p. 64, part (not *Dexia pristis* Walker, List 4, 1849, p. 841), holotype being specimen labeled "5736.01 Iss. 2 June '93," reared from *Halisidota argentata*, Aurora Mills, Oregon. Holotype No. 19151, U.S.N.M., male.

Differs from *Uramya* Robineau Desvoidy as follows: Abdomen of male much broader, caudal process comparatively short. Male tarsi only a little longer than tibiae. Arista practically bare. Middle legs not elongate.

ICTERICOPHYTO, new genus.

Genotype.—*Eulasiona spinosa* Coquillett, Rev. Tach., 1897, p. 53.

Differs from *Eulasiona* as follows: Female front at vertex fully as wide as one eye, widening but little anteriorly. Frontalia broad, occupying more than one-third width of front. Cheeks of female quite one-half eye-height. Third antennal joint of female broad, thick, about three times as long as the short second. Arista well thickened on basal half, becoming abruptly slender. Hind crossvein straight, much nearer to cubitus than to small crossvein. Apical cell widely open just before wingtip.

ICONOMEDINA, new genus.

Genotype.—*Degeeria washingtonae* Coquillett, Journ. N. Y. Ent. Soc., vol. 3, 1895, p. 104; Rev. Tach., 1897, p. 55, referred to *Medina*.

Differs from *Medina* as follows: Second aristal joint very elongate. Body and legs very stout. Front tarsi of female conspicuously thickened, widened, and flattened. Cheeks of female quite one-half eye-height. Front of female at vertex two-fifths head-width, the whole front averaging over one-half head-width, the face gradually widening therefrom. Frontalia of female over one-third width of front. Eyes thinly and faintly short-hairy. Frontal bristles reaching about to end of second antennal joint. Abdomen of female slightly broader than the thorax, suboval. Apical cell narrowly open a little before wingtip. Male unknown.

PYRAUSTOMYIA, new genus.

Genotype.—Panzeria penitalis Coquillett, Rev. Tach., 1897, p. 89.

Differs from *Phyllomya* as follows: *Male.*—Eyes hairy. No proclinate fronto-orbitals. Parafacials practically bare. Arista bare. Head about as long at oral margin as at antennae, epistoma well produced. Palpi stout, well thickened apically. Front about three-fifths eye-width on posterior half. Second antennal joint elongate. Whole body much broader, thorax and abdomen equaling head-width. Posterior one of the two lateral scutellar macrochaetae not much longer than the anterior one. First abdominal segment not so elongate, without macrochaetae other than laterals. Second segment without marginal row; but with median marginal, discal, and subdiscal pairs. Third segment with median discal and subdiscal pairs, of which one is often weaker, and marginal row. Costal spine present. Apical crossvein not bent in.

The holotype of the above species was reared by Dr. C. V. Riley from *Pyrausta penitalis* at St. Louis, Missouri, June 1, 1876.

XANTHOPHYTO, new genus.

Genotype.—Nemoraea labis Coquillett, Journ. N. Y. Ent. Soc., vol. 3, 1895, p. 104.

Differs from *Phyto* as follows:

Female.—Frontal bristles doubled or trebled anteriorly, descending to base of third antennal joint. Frontalia narrowing posteriorly. Eyes hairy. The single pair of inner fronto-orbitals divaricate. Antennae inserted very high, above upper three-fourths of eye, the frontal length only a little greater than facial. Parafacials bare. Palpi strong, thickened apically. Antennae stouter, the third joint longer and subtruncate apically. Macrochaetae of head stronger. Face a little broader. Abdomen broader. Apical cell widely open a little before wingtip, fourth vein continued in strong stump, apical and hind crossveins both nearly parallel with hind margin of wing. Tegulae broader and larger.

Family LARVAEVORIDAE.

LESKIOPSIS, new genus.

Genotype.—Myiobia thecata Coquillett, Journ. N. Y. Ent. Soc., vol. 3, 1895, p. 105; Rev. Tach., 1897, p. 67, referred to *Leskia.*

Differs from *Leskia* as follows: Front of male much narrower and slightly narrowing anteriorly or equilateral. Head subhemispherical, front not produced, epistoma not prominent, no ocellar bristles. Arista short-hairy. Palpi very slender. Cheeks very narrow in both sexes, eyes extending far below oral margin. Face much narrower; parafacials very narrow in both sexes, especially so in male. No median marginal macrochaetae on first abdominal segment in either sex. Claws very short in both sexes. Tarsi of both sexes slender. Hind crossvein straight, halfway between small crossvein and cubitus.

Differs from *Anthoica* and related genera by short claws, narrow male front, etc.

Differs from *Eumyobia* by the short proboscis, and by most of the characters of *Leskia* as to face and front, venation, etc.

Differs from *Ophirion* by the slender tarsi and short claws.

SIPHOLESKIA, new genus.

Genotype.—Drepanoglossa occidentalis Coquillett, Can. Ent., vol. 27, 1895, p. 126; Rev. Tach., 1897, p. 74, referred to *Epigrimyia.*

Differs from *Leskia* as follows: Proboscis elongate and slender, the part beyond geniculation much longer than head-height. Palpi longer, proportionately rather more slender. Epistoma much more prominent, projected anteriorly, the vibrissae set well back from oral margin. Apical cell widely open, ending a little before wingtip. Bend of fourth vein widely rounded, its course at cubitus being merely a broad curve.

The genus may be distinguished at once from *Parafischeria* Townsend by the longer proboscis, much narrower parafacials, and sinuate hind crossvein; from *Neofischeria* Townsend by the long proboscis and absence of discal macrochaetae on abdomen.

MYOBIOPSIS, new genus.

Genotype.—Myobiopsis similis Townsend, new species, for *Leskia analis* Coquillett, Rev. Tach., 1897, p. 67, part (not *Dexia analis* Say, Journ. Acad. Nat. Sci. Phila., vol. 6, 1829, p. 177), holotype being specimen labeled Andover, Massachusetts (Riley Coll.). Holotype, No. 19149, U.S.N.M., male. Paratypes include TD 4359, female; 4360, male.

Differs from *Eumyobia* as follows: Front and face about same length in both sexes. Inner vertical bristles present in male. Proboscis shorter. No median macrochaetae on first abdominal segment in either sex. Costal spine absent or vestigial. Apical cell practically closed in tip of wing. Hind crossvein about in middle between small crossvein and cubitus in male, slightly out of middle in female.

LESKIOPALPUS, new genus.

Genotype.—*Leskiopalpus calidus* Townsend, new species, for *Leskia analis* Coquillett, Rev. Tach., 1897, p. 67, part (not *Dexia analis* Say, Journ. Acad. Nat. Sci. Phila., vol. 6, 1829, p. 177), holotype being specimen labeled "Ithaca, N. Y. Coll. Chittenden." Holotype No. 19150, U.S.N.M., female.

Differs from *Myobiopsis* as follows: Proboscis stout, part below geniculation not as long as one eye. Palpi longer than antennae, curved, much widened on apical half, almost as wide as antennae. Apical cell widely open. Hind crossvein nearly straight, much nearer to cubitus than to small crossvein.

PARADEMOTICUS, new genus.

Genotype.—*Demoticus piperi* Coquillett, Rev. Tach., 1897, p. 122.

Differs from *Demoticus* as follows: Second aristal joint short. Parafacials broad. Cheeks of male a little less than one-half eye-height. Epistoma very prominent, projecting subhorizontally; vibrissae set well back from oral margin, but little longer than the closely-set peristomal bristles and barely differentiated therefrom, not decussate. Palpi stout-filiform, not thickened toward tip. Legs longer, stout. Apical cell widely open, ending well before wingtip, the last section of fourth vein long; hind crossvein much nearer cubitus, sinuate, subparallel with hind margin of wing. Abdomen with long bristly hairs.

HINEA, new genus.

Genotype.—*Nemoraea setigera* Coquillett, Proc. U. S. Nat. Mus., vol. 25, 1902, p. 111.

Differs from *Demoticus* as follows:

Female.—Front at vertex four-fifths of eye-width. Front strongly projecting in profile, facial profile strongly receding, the length of head at vibrissae about three-fifths that at base of antennae. Epistoma rather cut off, only faintly projecting. Third antennal joint fully twice the second, sharply truncate at tip, widening evenly from base to tip. Basal aristal joints short. Palpi swollen-rounded apically. Eyes thickly hairy. Sternopleurals, 1:1:1. Double discal pairs of bristles on median line of intermediate abdominal segments. Apical cell long-pointed, closed well before wingtip. Hind and apical crossveins closely approximated, nearly in line, subparallel with hind margin of wing. Fourth vein continued in long stump. Costal spine vestigial.

The genus is named in honor of Prof. J. S. Hine.

PELETERIOPSIS, new genus.

Genotype.—*Echinomyia flaviventris* Wulp, Biol. Centr.-Amer. Dipt., vol. 2, 1888, p. 32.

Differs from *Peleteria* as follows: Form stouter, abdomen much broadened. Cheeks distinctly less than eye-height. Parafacials much less than eye-width. Three or four strong proclinate fronto-orbitals in female, two in male. Palpi not so slender-filiform, more curved at tip, shorter. First two aristal joints elongate. Abdominal macrochaetae spinelike, erect. Second segment with four closely-placed median marginal macrochaetae. Anal segment bare of macrochaetae on less than front half. Small crossvein on middle of discal cell. Cubitus very much nearer to hind than to front margin of wing.

NOTE.—One female, head of Rio Piedras Verdes, Sierra Madre of Chihuahua, Mexico, about 7,300 feet, August 19, 1899 (Townsend); and one male, Rio Ruidoso, White Mountains of New Mexico, about 7,500 feet, August 3, 1898, on flowers of *Solidago trinervata* (Townsend). These may constitute a subspecies. They differ from Wulp's description mainly as follows: Whole face and cheeks pale golden. Anal segment brown, the color invading the yellow on hind median area of third segment. Wings lightly smoky throughout, tegulae yellowish-fuscous.

PELETERIOPSIS TEGULATA, new species.

Length of body, 13 to 13.5 mm.; of wing, 11.5 to 12 mm. Male and female, head of Rio Piedras Verdes, Sierra Madre of Chihuahua, Mexico, about 7,300 feet; the male July 15, 1899, on flowers of *Rhus glabra;* the female August 17, 1899 (Townsend).

Differs from the *P. flaviventris* specimens above mentioned as follows: Second antennal joint wholly clear rufous. Palpi much shorter. Tegulae white, with narrow brownish-yellow rims. Only two median marginal macrochaetae on second segment.

Holotype.—No. 19427, U.S.N.M., female. Allotype, male.

This form may be considered as representing subgenus B.

Family RHODOGYNIDAE.

OCYPTEROPSIS, new genus.

Genotype.—*Ocyptera flavifrons* Macquart, Dipt. Exot. Suppl., vol. 4 (suite), 1851, p. 187, pl. 20, fig. 1.

Differs from *Cylindromyia* as follows: Abdomen not cylindrical, gently but conspicuously broadening in middle from both base and tip. Proboscis slender, the part below geniculation conspicuously longer than lower border of head, pointed, labella not extruded laterally. Front of male at vertex about two-thirds eye-width. Arista slender, not stout. Hind femora of male conspicuously pilose on the inside and below, hind trochanters each with long thick curved tuft of hair. Ventral plates of male normally not concealed by the overlapping lateral sclerites; no pair of spined processes visible at extremity of fourth ventral plate as in male of *Cylindromyia.*

Two males: Australia (Koebele); Koorawatha, New South Wales, 1902 (H. Brown), through Froggatt. Length, 9 to 11 mm.

OCYPTERODES, new genus.

Genotype.—Ocyptera euchenor Walker, List IV, 1849, p. 696.

Differs from *Cylindromyia* as follows: Basal segment of female hypopygium shorter than anal segment; abdomen swollen, gradually widening, not of even width throughout after base. Second antennal joint of female longer, third shorter. Second aristal joint of female short. Male with four strong long appressed bristles on median ventral line at hind edge of second abdominal segment; female shows weak ones. Female without any grasping spines on venter, same as in *Cylindromyia.*

NEODIONAEA, new genus.

Genotype.—Dionaea nitoris Coquillett, Can. Ent., vol. 30, 1898, p. 235.

Differs from *Dionaea* as follows: Abdomen of female narrow and equilateral, that of male slightly widened. Forceps of female not toothed, unarmed on inner surface save some minute spines and bristles, terminal joint elongate. Only two median marginal macrochaetae on segments one and two in female, marginal row on segments two and three in male. Antennae distinctly separated. Costal spine vestigial.

Dionaea timberlakei Walton, Proc. Ent. Soc. Wash., vol. 16, 1914, p. 91, also belongs to this genus.

PARADIONAEA, new genus.

Genotype.—Leucostoma atra Townsend, Trans. Amer. Ent. Soc., vol. 18, 1891, p. 380.

Differs from the rest of the group as follows: Female forceps meeting apically at acute angle, armed with teeth. First two abdominal segments without marginal row of bristles, but with only median marginal pair and laterals; third and fourth segments with marginal row. Fourth segment of female with scattered hairs, but subglabrous anteriorly. Hairs of abdomen not long. Proboscis short. Epistoma produced downward, not projecting. Vibrissae above oral margin. Frontalia narrow, averaging one-third of frontal width in male, less than that in female. Tegulae not of extraordinary size in male, but larger than in female.

NEOPSALIDA, new genus.

Genotype.—Leucostoma neomexicana Townsend, Can. Ent., vol. 24, 1892, p. 169.

May be distinguished from *Leucostoma* and allies by the following characters: Proboscis no longer than head height, not slender. Male with weak reclinate ocellar bristles, those of about equal strength with the frontals and vibrissae, all rather hairlike; no verticals in male. Epistoma produced downward instead of forward. Lower border of head distinctly less than frontal length. Vibrissae inserted well above oral margin. Cheeks of male much broader than in *Siphopsalida,* being about one-fifth eye height or somewhat more. Face of male over one-half width of head. Third antennal joint no longer than the second. Abdomen clothed with long erect or suberect bristly hairs, from which the true macrochaetae are not always easily distinguished; last three segments with marginal row of bristles. No costal spine. Petiole of apical cell conspicuously shorter than hind cross-vein. Tegulae in the male normally of enormous size, nearly as wide as wings.

PARAPSALIDA, new genus.

Genotype.—Phyto nigricornis Townsend, Can. Ent., vol. 24, 1892, p. 170.

Form stout; thorax and abdomen heavily built, latter in male as deep as wide. Femora of male much thickened, even tibiae usually considerably thickened. Claws of male very long. First abdominal segment with four median marginal macrochaetae and some lateral marginals, but no complete row; segments two to four of male with complete row. Abdomen of male thickly short-hairy, the macrochaetae all very strong and conspicuously differentiated from the hairs. Venter longer-hairy, femora hairy. Front of male in middle one-third head-width. Epistoma produced downward. Frontalia wide, occupying fully one-third of male frontal width and often more. Vibrissae above oral margin. Proboscis short. Petiole of apical cell almost as long as hind crossvein. Macrochaetae of head strong in male, the reclinate ocellars strong as well as the frontals and vibrissae. Two verticals in male, the outer ones longer than the occipito-orbital fringe. Lower border of head nearly equal to frontal length. Male cheeks nearly one-third eye-height. Antennae well separated, the second and third joints equal in length. Male wings narrow and elongate; costal spine developed. Tegulae of male of ordinary size.

ODONTOSOMA, new genus.

Genotype.—Celatoria spinosa Coquillett, Rev. Tach., 1897, p. 60 (TD 4383, female).

Differs from *Celatoria* as follows: Female with hind lateral angles of tergal sclerites of segments two and three bearing 8 to 10 strong short spines in a patch, making four such patches showing on venter. Male abdomen much more elongate. Front of female averaging less than width of one eye, that of male less than half eye-width. Facial depression very shallow. Antennae shorter. Apical cell narrowly open.

Family PHASIIDAE.

OEDEMATOPTERYX, new genus.

Genotype.—Alophora pulverea Coquillett, Rev. Tach., 1897, p. 46.

Differs from *Alophoropsis* as follows: Male frontalia narrowed by parafrontals, which creep over them from each side in front of ocellar area. Male wings characteristically swollen on costal cell, faintly excavated on subcostal cell, more narrowed apically. Head, thorax, and abdomen much more narrowed in proportion to length of body. Abdomen heavily brassy-gray or gray pollinose in both sexes, opaque. Vibrissae hairlike, usually not differentiated from the peristomal bristles. No ocellar bristles.

Alophora fumosa Coquillett also belongs to this genus.

TRICHOCLYTIA, new genus.

Genotype.—Clytiomyia atrata Coquillett, Journ. N. Y. Ent. Soc., vol. 3, 1895, p. 53.

Differs from the genotype of *Clytiomya* (*helvola* Meigen) as follows: Front very narrow in both sexes, the eyes nearly contiguous. Abdomen clothed with fine hairs; no discal macrochaetae, no marginal row on second segment, at most very weak hairlike median marginal pair on second segment. All macrochaetae weak and bristlelike at best. Facial plate like *Phorantha*. Hind crossvein almost parallel with apical crossvein and close to origin of latter, both being nearly parallel with hind margin of wing. Claws of male extremely long.

Holotype is a female from the State of Washington (O. B. Johnson). There are two males from Julietta, Idaho, in the collection.

[SCIENTIFIC RESULTS OF THE PHILIPPINE CRUISE OF THE FISHERIES STEAMER "ALBATROSS," 1907–1910.—No. 33.]

THE EUPHAUSIACEAN CRUSTACEANS OF THE "ALBATROSS" EXPEDITION TO THE PHILIPPINES.

By H. J. Hansen,

Of Copenhagen, Denmark.

INTRODUCTION.

At the request of the Commissioner of Fisheries, I promised to work up the Schizopod Crustaceans and Sergestidae gathered by the United States Fisheries steamer *Albatross* during the Philippine expedition of 1907–1910, and the present paper, which is the first instalment, deals with the order Euphausiacea. Before entering on the description of the genera and species it may be appropriate to give a brief introduction.

The Schizopoda and the Sergestidæ are all free-swimming throughout life and may occur near the bottom, but are most often truly pelagic, living near the surface or in deeper layers of the ocean. Many species, especially of the order Mysidacea, inhabit shallow water not far from the coast, while most of the Euphausiacea and many Sergestidæ are truly oceanic. Consequently only a small number of the specimens, and especially of larger forms, were taken in the trawl or the dredge, the large majority having been secured in nets with other Plankton. Only a small portion of the animals had been sorted, but I received a large number of bottles containing Plankton samples. From the great majority of these samples all Schizopoda and Sergestidæ were removed under my supervision, but as several of the large bottles contained an immense number of these Crustacea, about one-third of the contents was taken out and the Schizopoda, etc., separated.

As the material of the Crustacea mentioned is very large, I found it necessary to divide it into three portions according to orders. Although the material of the Euphausiacea is larger than that of the two other groups, it was selected because I was sure that nearly all species were known beforehand, as most of the forms of this order have a very wide geographical distribution, and I had worked out the Schizopoda from the Dutch *Siboga* expedition, which had explored an adjacent area, namely, the seas and straits in the Indian Archipelago.

The list on the following pages shows that the collection is a very large one, being preserved in more than 200 vials and bottles, and comprising 29 species. Two of these species are new to science, but it may be pointed out that they are closely allied to well-known species; and here a comparison with the *Siboga* collection may be of interest.[1] The *Siboga* collected 25 species of Euphausiacea, and only three of these (*Bentheuphausia amblyops* G. O. Sars, *Euphausia paragibba* H. J. Hansen, and *Stylocheiron insulare* H. J. Hansen) are not represented in the Philippine material. Consequently this latter collection contains seven species not obtained by the *Siboga*; two of these species are new to science, but the five remaining species (*Thysanopoda pectinata* Ortmann, *T. cornuta* Illig, *Euphausia recurva* H. J. Hansen, *E. brevis* H. J. Hansen, and *Nematobrachion flexipes* Ortmann) are all known from the eastern tropical Pacific as well as from the Atlantic. It may be added that all the species from the Philippines excepting five, namely, three species of *Euphausia* (*E. similis* G. O. Sars, *E. hemigibba* H. J. Hansen, and *E. sibogæ* H. J. Hansen), and the two species established in the present paper, are known from the eastern tropical Pacific or the Fiji Islands and have been dealt with in my work on the Agassiz Schizopoda.[2] As all the Philippine forms—excepting the two new species—have been mentioned or described and figured either in the *Siboga* work or in the paper just mentioned, I have considered it unnecessary to give references to the literature or to deal with geographical distribution. Moreover, in a paper on the Euphausiacea of the United States National Museum recently published,[3] almost all the species enumerated in the following pages have been mentioned, as that Museum possessed them from other areas.

In hauls from 100 to 350 fathoms or more, frequently several species were present, while hauls from near the surface generally contained only a few forms or even a single species, but not infrequently an enormous number of specimens of one or two species. Four species, namely, *Thysanopoda tricuspidata* Milne Edwards, *Euphausia pseudogibba* Ortmann, and especially *Euphausia diomedeae* Ortmann, and *Pseudeuphausia latifrons* G. O. Sars, have not only been taken at a number of places, but sometimes in such large numbers that one may safely conclude that these animals have considerable value as food for fishes. But it need scarcely be said that an investigation of a large number of stomachs of various food-fishes must be undertaken before it will be possible to pronounce a well-founded judgment on the relative significance of the species of Euphausiacea as food material.

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[1] See my report in *Siboga*-Expeditie, monograph 37, 1910.

[2] Mem. Mus. Comp. Zool., vol. 35, No. 4, 1912.

[3] Proc. U. S. Nat. Mus., vol. 48, 1915, pp. 59-114.

In the following lists I have arranged the stations according to latitude north, beginning with the most northern locality. The area explored is narrow-oblong, as the distance between the northern and southern boundaries is about three times as great as that between the western and eastern.

DESCRIPTIONS OF SPECIMENS.

THYSANOPODA Milne Edwards.

The collection contains 6 of the 11 species hitherto known.

1. THYSANOPODA TRICUSPIDATA Milne Edwards.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 6 specimens, small or half-grown.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 1 larva.

D. 5436. May 7, 1909. Off Corregidor Light, west coast of Luzon. Lat. 14° 22′ 37″ N.; long. 120° 29′ E. Surface. 7.03 p. m. Surf. temp. 86°. 1 specimen (sublarval).

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 2 specimens, half-grown.

D. 5288. July 22, 1908. Off Matocot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. 1 specimen (sublarval).

D. 5457. June 8, 1909. Off Legaspi Point, east coast of Luzon. Lat. 13° 12′ N.; long. 123° 49′ 40″ E. 146 fathoms. 9.40 a. m. 3 specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. 2 specimens (sublarval).

D. 5539. August 19, 1909. Off Apo Island. Lat. 9° 03′ 20″ N.; long. 123° 24′ 45″ E. Surface. 7.11 p. m. Surf. temp. 83°. 1 small specimen.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 1.25 a. m. Surf. temp. 84°, bot. 53.5°. 9 specimens.

D. 5544. September 6, 1909. Off Coronado Point, northern Mindanao. Lat. 8° 16′ 30″ N.; long. 122° 26′ 30″ E. 600 fathoms. 11.17 a. m. Bot. temp. 49.8°. 1 specimen.

D. 5553. September 17, 1909. Sulade Island, anchorage. Lat. 5° 51′ N.; long. 120° 46′ 30″ E. Surface. 7.28 p. m. Surf. temp. 83°. 1 specimen, very small.

D. 5649. December 16, 1909. Off North Island, Buton Strait. Lat. 5° 36′ N.; long. 122° 07′ 36″ E. Surface. 7.23 p. m. Surf. temp. 83°. 4 specimens, half-grown.

D. 5600. November 7, 1909. North of Celebes. Lat. 2° 05′ N.; long. 123° 52′ 30″ E. Surface. 7.06 p. m. Surf. temp. 82°. Large number of specimens.

D. 5616. November 22, 1909. Off Tiforo Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. Large number of specimens.

D. 5627. November 30, 1909. Off Kayoa Island, Molucca Passage. Lat. 0° 06′ N.; long. 127° 26′ E. 5 fathoms. 6.02 p. m. Surf. temp. 83° 2 specimens, not adult.

D. 5672. December 30, 1909. Off Dongala Light, Macassar Strait. Lat. 0° 29′ S.; long. 118° 51′ E. Surface. 7.26 p. m. Surf. temp. 83°. About 20 specimens, half-grown.

D. 5611. November 19, 1909. Off Buka Buka Island, Gulf of Tomini, Celebes. Lat. 0° 40′ 30″ S.; long. 121° 50′ E. Surface. 7.14 p. m. Surf. temp. 84°. 10 specimens (1 adult, 9 very small).

D. 5633. December 2, 1909. Off Selang Point. Lat. 1° 03′ S.; long. 127° 44′ E. Surface. 7.14 p. m. Surf. temp. 84°. Enormous number of specimens.

D. 5669. December 29, 1909. Off Mamuju Island, Macassar Strait. Lat. 2° 19′ 30″ S.; long. 118° 50′ E. Surface. 7.25 p. m. Surf. temp. 84°. Numerous specimens.

Without label. Immense number of specimens.

Remarks.—One of the largest females, in the bottle without label, measures 26 mm. in length.

2. THYSANOPODA MONOCANTHA Ortmann.

D. 5288. July 22, 1908. Off Matocot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. 1 specimen.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 2 specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. 3 larvæ.

D. 5497. August 3, 1909. Off Bantigui Island. Lat. 9° 07′ 15″ N.; long. 124° 59′ 30″ E. 800 fathoms. 10.59 a. m. Bot. temp. 52.3°. 1 specimen.

D. 5129. February 5, 1908. Off western Mindanao. Lat. 7° 41′ 30″ N.; long. 122° 01′ 45″ E. 100 fathoms. 2.23 p. m. Bot. temp. 57.6°. 1 specimen (older larva).

3. THYSANOPODA ÆQUALIS H. J. Hansen,

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p.m. Bot. temp. 36.2°, dens. 1.02574. 1 specimen, half-grown.

D. 5457. June 8, 1909. Off Legaspi Point, east coast of Luzon. Lat. 13° 12′ N.; long. 123° 49′ 40″ E. 146 fathoms. 9.40 a. m. 3 small specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. 7 specimens, half-grown.

4. THYSANOPODA PECTINATA Ortmann.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 1 specimen (adult male.)

5. THYSANOPODA ORIENTALIS H. J. Hansen.

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 3 specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 8 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9.00 p. m. ½ specimen.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Bot. temp. 53.5°. 5 specimens.

D. 5544. September 6, 1909. Off Coronado Point, northern Mindanao. Lat. 8° 16′ 30″ N.; long. 122° 26′ 30″ E. 600 fathoms. 11.17 a. m. Bot. temp. 49.8°. 1 specimen.

6. THYSANOPODA CORNUTA Illig.

D. 5471. June, 1909. Off Sialat Point Light, east coast of Luzon. Lat. 13° 34′ 57″ N.; long. 123° 47′ 06″ E. 568 fathoms. 9.17 a. m. 2 specimens.

Remarks.—One of the specimens, an adult female, is very large, measuring 81.5 mm. from the front margin of the carapace to the end of telson.

Genus EUPHAUSIA Dana.

Of this very large genus the collection contains 10 species, one of which is new.

7. EUPHAUSIA DIOMEDEÆ Ortmann.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p.m. Surf. temp. 79°. 18 specimens.

November 11, 1908. Port San Pio Quinto, China Sea. (About lat. 21° N.; long. 122° E.) 5 feet. 9 a. m. 1 specimen.

D. 5436. May 7, 1909. Off Corregidor Light, west coast of Luzon. Lat. 14° 22′ 37″ N.; long. 120° 29′ E. Surface. 7.03 p. m. Surf. temp. 86°. 1 specimen.

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 1 specimen.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. Numerous specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 17 specimens.

D. 5176. March 24, 1908. Off Escarceo Light, Verde Island Passage. Lat. 13° 35′ 15″ N.; long. 120° 53′ 20″ E. Surface. 7.01 p. m. Surf. temp. 79°. About 25 specimens.

D. 5456. June 7, 1909. Off Legaspi Light, east coast of Luzon. Lat. 13° 11′ 10″ N.; long. 123° 51′ 52″ E. 120 fathoms. 12.55 p. m. Immense number of half-grown specimens.

D. 5195. April 3, 1908. Off Capitancillo Island, off northern Cebu Island. Lat. 10° 47′ N.; long. 124° 06′ 30″ E. Surface. 7.03 p. m. Surf. temp. 84°, dens. 1.02514. About 40 specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. About 130 specimens.

D. 5258. June 2, 1908. Off southern Panay. Lat. 10° 27′ 45″ N.; long. 122° 12′ 30″ E. Surface. 7.08 p. m. Surf. temp. 84°, dens. 1.02587. 1 specimen.

D. 5190. April 1, 1908. Off Pescador Island. Lat. 10° 08′ 15″ N.; long. 123° 16′ 45″ E. 250 fathoms. 4.39 p. m. Bot. temp. 63°, dens. 1.02482. 3 specimens.

D. 5232. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 45″ N.; long. 124° 44′ 06″ E. Surface. 8.25 p. m. Surf. temp. 84°, dens. 1.02531. 8 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9.00 p. m. Immense number of specimens.

D. 5234. May 7, 1908. Off Limasaua Island. Lat. 10° N.; long. 124° 46′ 06″ E. 15 fathoms. 9.42 p. m. Surf. temp. 84°, dens. 1.02531. 7 specimens.

D. 5531. August 11, 1909. Off Balicasag Island. Lat. 9° 27′ 30″ N.; long. 123° 38′ E. Surface. 7.49 p. m. Surf. temp. 84°. Immense number of specimens.

D. 5530. August 11, 1909. Off Balicasag Island. Lat. 9° 26′ 45″ N.; long. 123° 38′ 30″ E. Surface. 7.14 p. m. Surf. temp. 84°. Immense number of specimens.

D. 5495. August 2, 1909. Off Diuata Point, between Leyte and Mindanao. Lat. 9° 06′ 30″ N.; long. 125° 00′ 20″ E. 600 fathoms. 1.54 p. m. Bot. temp. 52.3°. About 30 specimens.

D. 5539. August 19, 1909. Off Apo Island. Lat. 9° 03′ 20″ N.; long. 123° 24′ 45″ E. Surface. 7.11 p. m. Surf. temp. 83°. 20 specimens.

D. 5540. August 19, 1909. Off Apo Island. Lat. 9° 03′ N.; long. 123° 24′ 30″ E. Surface. 7.42 p. m. Surf. temp. 83°. 30 specimens.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°, bot. 53.5°. Immense number of specimens, mostly half-grown.

August 4, 1909. Opol, Macajalar Bay, Mindanao. (About lat. 8° 37¾′ N.) 5–12 feet. 1 p. m. 1 specimen.

D. 5544. September 6, 1909. Off Coronado Point, northern Mindanao. Lat. 8° 16′ 30″ N.; long: 122° 26′ 30″ E. 600 fathoms. 11.17 a. m. Bot. temp. 49.8°. 6 specimens.

D. 5600. November 7, 1909. North of Celebes. Lat. 2° 05′ N.; long. 123° 52′ 30″ E. Surface. 7.06 p. m. Surf. temp. 82°. About 30 specimens.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. 8 specimens.

D. 5672. December 30, 1909. Off Dongala Light, Macassar Strait. Lat. 0° 29′ S.; long. 118° 51′ E. Surface. 7.26 p. m. Surf. temp. 83°. Immense number of specimens.

D. 5611. November 19, 1909. Off Buka Buka Island, Gulf of Tomini, Celebes. Lat. 0° 40′ 30″ S.; long. 121° 50′ E. Surface. 7.14 p. m. Surf. temp. 84°. Numerous specimens.

D. 5633. December 2, 1909. Off Selang Point. Lat. 1° 03′ S.; long. 127° 44′ E. Surface. 7.14 p. m. Surf. temp. 84°. Enormous number of specimens.

D. 5669. December 29, 1909. Off Mamuju Island. Macassar Strait. Lat. 2° 19′ 30″ S.; long. 118° 50′ E. Surface. 7.25 p. m. Surf. temp. 84°. Numerous specimens.

D. 5649. December 16, 1909. Off North Island, Buton Strait. Lat. 5° 36′ S.; long. 122° 07′ 36″ E. Surface. 7.23 p. m. Surf. temp. 83°. Numerous specimens.

Remarks.—The long list of localities shows that this species is not only commonly distributed in the area explored, but that it is extremely abundant at the surface at certain stations.

8. EUPHAUSIA MUTICA H. J. Hansen.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 11 specimens.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 6 specimens.

D. 5581. September 25, 1909. Off Bumbum Island, near Darvel Bay, Borneo. Lat. 4° 30′ 25″ N.; long. 118° 41′ 30″ E. Ship at anchor. Surface. 5.55 p. m. Surf. temp. 83°. 1 specimen.

D. 5600. November 7, 1909. North of Celebes. Lat. 2° 05″ N.; long. 123° 52′ 30″ E. Surface. 7.06 p. m. Surf. temp. 82°. About 30 specimens.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. About 30 specimens.

D. 5672. December 30, 1909. Off Dongala Light, Macassar Strait. Lat. 0° 29′ S.; long. 118° 51′ E. Surface. 7.26 p. m. Surf. temp. 83°. 19 specimens.

D. 5649. December 16, 1909. Off North Island, Buton Strait. Lat. 5° 36′ S.; long. 122° 07′ 36″ E. Surface. 7.23 p. m. Surf. temp. 83°. 17 specimens.

9. EUPHAUSIA RECURVA H. J. Hansen.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. About 25 specimens.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. About 30 specimens.

10. EUPHAUSIA BREVIS H. J. Hansen.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 1 specimen.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. 1 specimen.

11. EUPHAUSIA SIMILIS G. O. Sars.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 1 specimen.

Remarks.—The specimen captured is an adult male, which is quite normal, agreeing with the specimens captured by the *Challenger* and the Swedish Antarctic Expedition.

12. EUPHAUSIA TENERA H. J. Hansen.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 14 specimens.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 14 specimens.

D. 5288. July 22, 1908, Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. 1 specimen.

D. 5456. June 7, 1909. Off Legaspi Point, east coast of Luzon. Lat. 13° 11′ 10″ N.; long. 123° 51′ 52″ E. 120 fathoms. 12.55 p. m. 1 specimen.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. About 25 specimens.

D. 5553. September 17, 1909. Sulade Island, anchorage. Lat. 5° 51′ N.; long. 120° 46′ 30″ E. Surface. 7.28 p. m. Surf. temp. 83°. 1 specimen.

D. 5600. November 7, 1909. North of Celebes. Lat. 2° 05′ N.; long. 123° 52′ 30″ E. Surface. 7.06 p. m. Surf. temp. 82°. 6 specimens.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. About 25 specimens.

D. 5672. December 30, 1909. Off Dongala Point, Macassar Strait. Lat. 0° 29′ S.; long. 118° 51′ E. Surface. 7.26 p. m. Surf. temp. 83°. 6 specimens.

D. 5611. November 19, 1909. Off Buka Buka Island, Gulf of Tomini, Celebes. Lat. 0° 40′ 30″ S.; long. 121° 50′ E. Surface. 7.14 p. m. Surf. temp. 84°. About 30 specimens.

D. 5633. December 2, 1909. Off Selang Point. Lat. 1° 03′ S.; long. 127° 44′ E. Surface. 7.14 p. m. Surf. temp. 84°. 4 specimens.

D. 5669. December 29, 1909. Off Manuju Island, Macassar Strait. Lat. 2° 19′ 30″ S.; long. 118° 50′ E. Surface. 7.25 p. m. Surf. temp. 84°. About 30 specimens.

13. EUPHAUSIA PSEUDOGIBBA Ortmann.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 6 specimens.

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 6 specimens.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. About 125 specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 8 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. About 20 specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. Large number of specimens.

D. 5531. August 11, 1909. Off Balicasag Island. Lat. 9° 27′ 30″ N.; long. 123° 38′ E. Surface. 7.49 p. m. Surf. 84°. 2 specimens.

D. 5495. August 2, 1909. Off Diuata Point, between Leyte and Mindanao. Lat. 9° 06′ 30″ N.; long. 125° 00′ 20″ E. 600 fathoms. 1.54 p. m. Bot. temp. 52.3°. 1 specimen.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 87°, bot. 53.5°. Large number of specimens.

D. 5581. September 25, 1909. Off Bumbum Island, near Darvel Bay, Borneo. Lat. 4° 30′ 25″ N.; long. 118° 41′ 30″ E. Ship at anchor. Surface. 5.55 p. m. Surf. temp. 83°. 1 specimen.

D. 5600. November 7, 1909. North of Celebes. Lat. 2° 05′ N.; long. 123° 52′ 30″ E. Surface. 7.06 p. m. Surf. temp. 82°. 2 specimens.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. 3 specimens.

D. 5672. December 30, 1909. Off Dongola Light, Macassar Strait. Lat. 0° 29′ S.; long. 118° 51′ E. Surface. 7.26 p. m. Surf. temp. 83°. About 20 specimens.

D. 5633. December 2, 1909. Off Selang Point. Lat. 1° 03′ S.; long. 127° 44′ E. Surface. 7.14 p. m. Surf. temp. 84°. Large number of specimens.

D. 5669. December 29, 1909. Off Mamuju Island, Macassar Strait. Lat. 2° 19′ 30″ S.; long. 118° 50′ E. Surface. 7.25 p. m. Surf. temp. 84°. 8 specimens.

D. 5649. December 16, 1909. Off North Island, Buton Strait. Lat. 5° 36′ S.; long. 122° 07′ 36″ E. Surface. 7.23 p. m. Surf. temp. 83°. Immense number of specimens.

Remarks.—The list shows that *E. pseudogibba* has been taken not only in deeper layers of the sea but several times at the surface, and there sometimes in large numbers.

14. EUPHAUSIA HEMIGIBBA H. J. Hansen.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 5 specimens.

15. EUPHAUSIA SIBOGÆ H. J. Hansen.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. Numerous specimens.

D. 5553. September 17, 1909. Sulade Island, anchorage. Lat. 5° 51′ N.; long. 120° 46′ 30″ E. Surface. 7.28 p. m. Surf. temp. 83°. 4 specimens.

16. EUPHAUSIA FALLAX, new species.

Plate 83, figs. 1*a*–1*d*.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. About 20 specimens.

Type-locality.—D. 5532. August 13, 1909. Off Gigantangan Island, between Masbate and Leyte. Lat. 11° 36′ 39″ N.; long. 124° 13′ 30″ E. Surface. 7.14 p. m. Surf. temp. 84°. Immense number of specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. Many small specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. 7 specimens.

D. 5539. August 19, 1909. Off Apo Island. Lat. 9° 03′ 20″ N.; long. 123° 24′ 30″ E. Surface. 7.11 p. m. Surf. temp. 83°. 4 specimens.

Description.—This species is very similar and closely allied to *E. gibboides* Ortmann, as described and figured by me.[1] In reality I have been unable to find any specific differences between the two species in the shape of the frontal plate, the rostrum, the gastric area, the eyes, the antennular peduncles, etc. Third abdominal segment has the dorsal middle of the hind margin a little or somewhat produced, and this produced part is either frequently rounded, or terminates in a small and extremely slender spiniform process.

The male copulatory organs (figs. 1*a*–1*d*) of first pleopods afford some striking characters. The terminal process (p^2) has the foot of moderate length and the heel rather short, thick, straight; the process beyond the foot is moderately long, seen from behind (fig. 1*b*) straight, moderately stout, not tapering beyond the middle, and with the end obtuse; seen from the inner side (fig. 1*c*), it is somewhat curved forward at the middle, widening from the middle (fig. 1*d*) toward the end, which has two conspicuous incisions dividing the terminal part into three teeth; the median tooth is long, somewhat curved, acute; the posterior tooth is smaller but at least twice as long as broad; the third tooth is small, triangular, shorter than broad. The proximal process (p^3) is long and nearly regularly curved, thickened near the base on the outer side and the terminal part is very expanded, but this expanded part differs considerably from that in *E. gibboides;* that expansion, seen from the inner side (fig. 1*d*) is vertical on the process (in *E. gibboides* it is very oblique) and its anterior narrow part is narrower and much longer than in *E. gibboides.* The median lobe has no protruding, acute triangle on the proximal part of the inner margin; the distal part is broad seen from behind with the distal margin broadly rounded; seen from the inner side (fig. 1*c*) the lobe has the terminal margin long and a little oblique, while the terminal angle is about 70°; in *E. gibboides* the lobe has an acute, protruding tubercle on the inner margin, and the distal part is produced into a somewhat oblong triangle with the end acute. The lateral process (p^4) has the major part strongly curved and without any accessory tooth.

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[1] Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 252, pl. 9, figs. 2*a*–2*h*.

Length of a large female, 18 mm.; of a large male, 17.5 mm.

The *type,* a male, is Cat. No. 47890, U.S.N.M.

The *paratype,* a female, is Cat. No. 47889, U.S.N.M.

Remarks.—The differences between the distal parts of the terminal and proximal processes and the median lobe of the copulatory organs in *E. fallax* and those in *E. gibboides* are so strong that the two species are well separated. Besides, *E. fallax* is considerably smaller than *E. gibboides.* The females of the two species are difficult to separate; in *E. gibboides* the process on third abdominal segment is always present and at least in larger specimens stronger and more developed than in *E. fallax.*

Genus PSEUDEUPHAUSIA H. J. Hansen.

Only a single species is known.

17. PSEUDEUPHAUSIA LATIFRONS G. O. Sars.

January 15, 1908. Nasugbu Bay, Luzon. (About lat. 13° 55′ N.) Anchorage. Surface. 7 p. m. Electric light. 1 specimen.

January 21, 1908. Nasugbu Bay, Luzon. Anchorage. Surface. 7.30 p. m. Large number of specimens.

February 20, 1909. Taal anchorage, Balayan Bay, Luzon. (About lat. 13° 48′ N., long. 120° 45′ E.) Surface. 7.30 p. m. 1 specimen.

July 22, 1908. Varadero Bay, anchorage. Lat. 13° 40′ 09″ N.; long. 120° 59′ 30″ E. 6–15 feet. 8 p. m. Immense number of specimens.

July 22, 1908. Varadero Harbor. 10.30–11.30 p. m. Numerous specimens.

July 22, 1908. Varadero Harbor. 11.30–12.30 a. m. 6 specimens.

June 18, 1909. Lagonoy Gulf, Nato Anchorage, east coast of Luzon. (Near lat. 13° 37′ N.) Surface. 7.30 p. m. 3 specimens.

March 9, 1909. Ragay Bay, anchorage, Luzon. (About lat. 13½° N.) Surface. 7 p. m. Many specimens.

March 5, 1909. Ragay Gulf, Luzon. 3 specimens.

March 9, 1909. Refugio Island, Pasacao Anchorage, Ragay Gulf, Luzon. 12–30 feet. 8 a. m. Electric light. Immense number of specimens.

June 3, 1908. Mansalay Bay, anchorage, Mindoro. (About lat. 12½° N.) Surface. 9 p. m. Numerous specimens.

December 20, 1908. Bolalo Bay, Palawan Island. (About lat. 11° N.) Anchorage. Surface. 8.30 p. m. Electric light. Immense number of specimens.

D. 5340. December 22, 1908. Off Cone Island, Melampaya Sound, Palawan Island. Lat. 10° 55′ 51″ N; long. 119° 14′ 12″ E. 17–22 fathoms. 8.22 a. m. Surf. temp. 80°. 44 specimens.

December 23, 1908. Endeavour Strait, anchorage between Bando and Endeavour Points. (About lat. 10° 55′ N.) Surface. 8 p. m. Many specimens, larva and young.

December 23, 1908. Endeavour Strait. Surface. 8.30 p. m. Electric light. About 20 specimens, full-grown.

D. 5125. February 3, 1908. Off Nogas Island, Panay, Sulu Sea. Lat. 10° 48′ N.; long. 121° 48′ 30″ E. 365 fathoms. 9.41 a. m. Bot. temp. 50°, dens. 1.02475. 2 specimens.

D. 5352. December 30, 1908. Off Tidepole Point, Ulugan Bay, Palawan Island. Lat. 10° 04′ 30″ N.; long. 119° 05′ E. 24 fathoms. 6.18 a. m. Surf. temp. 81°. 23 specimens.

D. 5531. August 11, 1909. Off Balicasag Island. Lat. 9° 27′ 30″ N.; long. 123° 38′ E. Surface. 7.49 p. m. Surf. temp. 84°. 3 specimens.

August 4, 1909. Opol, Macajalar Bay, Mindanao. (About 8° 37′ N.) 5–12 feet. 1 p. m. 3 specimens.

D. 5595. October 6, 1909. Zamboanga, Mindanao. Lat. 6° 54′ N.; long. 122° 04′ 30″ E. Ship at anchor. Surface. 7.13 p. m. Surf. temp. 80°. 1 specimen.

D. 5596. October 10, 1909. Zamboanga, Mindanao. Ship at anchor. Surface. 6 p. m. Surf. temp. 81°. 1 specimen.

D. 5553. September 17, 1909. Sulade Island, anchorage. Lat. 5° 51′ N.; long. 120° 46′ 30″ E. Surface. 7.28 p. m. Surf. temp. 83°. About 35 specimens.

D. 5568. September 22, 1909. Off Singaan Island, north of Tawi Tawi. Lat. 5° 45′ 50″ N.; long. 120° 26′ E. Surface. 6.35 p. m. Surf. temp. 83°. 4 specimens.

February 26, 1908. Tumindao Island, anchorage, Sulu Archipelago. (About lat. 4⅔° N.) 9–15 feet. 2 specimens.

D. 5588. September 28, 1909. Off Mabul Island, near Borneo. Lat. 4° 14′ 20″ N.; long. 118° 36′ 48″ E. Ship at anchor. Surface. 6.10 p. m. Surf. temp. 82°. Immense number of specimens.

D. 5600. November 7, 1909. North of Celebes. Lat. 2° 05′ N.; long. 123° 52′ 30″ E. Surface. 7.06 p. m. Surf. temp. 82°. About 40 specimens.

November 9, 1909. Talisse Island, north of Celebes. (About lat. 2° N.) 10–18 feet. 6 a. m. About 35 specimens.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. 3 specimens.

D. 5633. December 2, 1909. Off Selang Point. Lat. 1° 03′ S.; long. 127° 44′ E. Surface. 7.14 p. m. Surf. temp. 84°. About 35 specimens.

Remarks.—The long list of localities shows that this small and very characteristic form is widely distributed in the Philippine Archipelago; it is especially common in shallow water near the coast and occurs sometimes in vast numbers.

Genus NEMATOSCELIS G. O. Sars.

Of this sharply defined genus six species have been established, three of which are represented in the collection, which also includes a new species.

18. NEMATOSCELIS MICROPS G. O. Sars.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 13 specimens.

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 4 specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 6 specimens.

19. NEMATOSCELIS LOBATA, new species.

Plate 83, figs. *2a–2f.*

Type-locality.—D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. Immense number of specimens.

D. 5248. May 18, 1908. Off Lanang Point, Gulf of Davao. Lat. 7° 07′ 25″ N.; long. 125° 40′ 24″ E. 18 fathoms. 10.38 a. m. Surf. temp. 83°, dens. 1.02453. 2 specimens.

Description.—Very similar and closely allied to *N. microps*, but a little more slender. Rostrum in the female (fig. 2*a*) long, moderately narrow, at the broader base not marked off from the frontal plate; in the male (fig. 2*b*) the rostrum is acute, triangular, short, about reaching the middle of the transverse thickening between the eye-stalks, a little shorter than broad and scarcely or not marked off from the frontal plate. Carapace in the adult male with a distinct marginal denticle a little from the posterior end, in the adult female without any denticle.

Eyes decidedly smaller than in specimens of *N. microps* of the same size; their upper section is conspicuously smaller than the lower. Antennular peduncles in the female as in *N. microps*, in the male not quite so thick as in this species and its lower flagellum without any curved basal portion. Prehensile legs nearly as in *N. gracilis*.

The male copulatory organs of first pleopods (figs. 2*c*–2*f*) show peculiar features. The inner lobe is obliquely rounded, with the result that the spine-shaped process (p^1) originates not only considerably more proximally than the terminal process (p^2), but even more proximally than the proximal process (p^3). The spine-shaped process (p^1) is long, nearly as long as, or longer than, the proximal process (p^3) and from a little less to a little more than twice as long as the terminal process (p^2), which is short, somewhat conical. The proximal process is thick at the base and tapers to the subacute or blunt end; it is frequently curved, sometimes nearly straight. The median lobe (*lm*) is uncommonly large, not twice as long as broad, with the outer margin and the somewhat curved terminal margin forming together a long very arcuate line, while the inner margin is flatly convex and at its end an acute or subacute terminal angle is found; the lateral process (p^4), which is very small, is placed near the base of the lobe just opposite the insertion of the proximal process. The auxiliary lobe is somewhat short; the setiferous lobe is moderately broad, reaches distinctly beyond the median lobe, and has only six setae.

Length of a large female, 14.5 mm.; of an adult male, 12 mm.

The *type*, a male, is Cat. No. 47888, U.S.N.M.

The *paratype* a female, is Cat. No. 47889, U.S.N.M

Remarks.—*N. lobata* is smaller and more slender than *N. microps*, with somewhat smaller eyes. But the male copulatory organs afford the best characters; the median lobe differs widely in shape and size from that in *N. microps* or *N. atlantica*, the terminal process is considerably shorter than in *N. microps;* the inner and the median lobes and their processes show several other peculiar features mentioned above. All my specimens, several hundred, have a peculiar grayish color, but I do not know whether that may be due to the preservation or not. *N. lobata* is easily separated from *N. gracilis* by the shape of rostrum in both sexes and by the lower antennular flagellum and the copulatory organs in the male.

20. NEMATOSCELIS GRACILIS H. J. Hansen.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Surf. temp. 80°, bot. temp. 36.2°, dens. 1.02574. 8 specimens.

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 6 specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 34′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 13 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. Large number of specimens.

D. 5531. August 11, 1909. Off Balicasag Island. Lat. 9° 27′ 30″ N.; long. 123° 38′ E. Surface. 7.49 p. m. Surf. temp. 84°. 2 specimens.

D. 5495. August 2, 1909. Off Diuata Point, between Leyte and Mindanao. Lat. 9° 06′ 30″ N.; long. 125° 00′ 20″ E. 600* fathoms. Surf. temp. 83°, bot. 52.3°. 2 specimens (male and female).

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°, bot. 53.5°. 11 specimens.

D. 5544. September 6, 1909. Off Coronado Point, northern Mindanao. Lat. 8° 16′ 30″ N.; long. 122° 26′ 30″ E. 600 fathoms. 11.17 a. m. Bot. temp. 49.8°. 2 specimens.

21. NEMATOSCELIS TENELLA G. O. Sars.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 4 specimens.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. 4 specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°, dens. 1.02521. 12 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. 1 specimen.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°, bot. 53.5°. 1 specimen.

Genus NEMATOBRACHION Calman.

The collection contains two of the three species hitherto known.

22. NEMATOBRACHION BOOPIS Calman.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 1 specimen, young.

D. 5120. January 21, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 45′ 30″ N.; long. 120° 30′ 15″ E. 350 fathoms. 3.10 p. m. Bot. temp. 43.7°, dens. 1.02480. 1 specimen.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11. 25 a. m. Surf. temp. 84°, bot. 53.5°. 3 specimens, young.

23. NEMATOBRACHION FLEXIPES Ortmann.

D. 5457. June 8, 1909. Off Legaspi Light, east coast of Luzon. Lat. 13° 12′ N.; long. 123° 49′ 40″ E. 146 fathoms. 9.40 a. m. 1 specimen.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. 2 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9.00 p. m. 12 specimens.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°, bot. 53.5°. 16 specimens.

Genus STYLOCHEIRON G. O. Sars.

The collection contains six of the nine species known.

24. STYLOCHEIRON CARINATUM G. O. Sars.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 2 specimens.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 6 specimens.

June 18, 1909. Lagonoy Gulf, Nato Anchorage, east coast of Luzon. (Near lat. 13° 37′ N.). Surface. 7.30 p. m. 1 specimen.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. Immense number of specimens.

D. 5553. September 17, 1909. Sulade Island, anchorage. Lat. 5° 51′ N.; long. 120° 46′ 30″ E. Surface. 7.28 p. m. Surf. temp. 83°. 5 specimens.

D. 5611. November 19, 1909. Off Buka Buka Island, Gulf of Tomini, Celebes. Lat. 0° 40′ 30″ S.; long. 121° 50′ E. Surface. 7.14 p. m. Surf. temp. 84°. About 50 specimens.

25. STYLOCHEIRON LONGICORNE G. O. Sars.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 10 specimens.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms.. 8.14 a. m. 3 specimens.

D. 5456. June 7, 1909. Off Lagaspi Point, east coast of Luzon. Lat. 13° 11′ 10″ N.; long. 123° 51′ 52″ E. 120 fathoms. 12.55 p. m. 1 specimen.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. 1 specimen.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 p. m. Surf. temp. 84°, bot. 53.5°. 1 specimen.

26. STYLOCHEIRON AFFINE H. J. Hansen.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 171° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 2 specimens.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 800 fathoms. 2.25 p. m. Bot. temp. 36.2°, dens. 1.02574. 2 specimens.

D. 5287. July 20, 1908. Off Sombrero Island, near southern Luzon. Lat. 13° 37′ 40″ N.; long. 120° 39′ E. 310 fathoms. 2.58 p. m. Bot. temp. 43.4°; dens. 1.02521. 4 specimens.

D. 5456. June 7, 1909. Off Lagaspi Point, east coast of Luzon. Lat. 13° 11′ 10″ N.; long. 123° 51′ 52″ E. 120 fathoms. 12.55 p. m. About 40 specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. 9 specimens.

D. 5190. April 1, 1908. Off Pescador Island. Lat. 10° 08′ 15″ N.; long. 123° 16′ 45″ E. 250 fathoms. 4.39 p. m. Bot. temp. 63°; dens. 1.02482. 1 specimen.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. 4 specimens.

D. 5495. August 2, 1909. Off Diuata Point, between Leyte and Mindanao. Lat. 9° 06′ 30″ N.; long. 125° 00′ 20″ E. 600 fathoms. 1.54 p. m. Bot. temp. 52.3°. 3 specimens.

D. 5500. August 4, 1909. Off Macabalan Point, Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°; bot. 53.5°. 8 specimens.

D. 5544. September 6, 1909. Off Coronado Point, northern Mindanao. Lat. 8° 16′ 30″ N.; long. 122° 26′ 30″ E. 600 fathoms. 11.17 a. m. Bot. temp. 49.8°. 5 specimens.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 fathoms. 6.44 p. m. Surf. temp. 84°. 1 specimen.

27. STYLOCHEIRON MICROPHTHALMA H. J. Hansen.

D. 5319. November 5, 1908. China Sea. Lat. 21° 31′ N.; long. 117° 53′ E. 20 fathoms. 7.23 p. m. Surf. temp. 79°. 2 specimens.

D. 5320. November 6, 1908. China Sea. Lat 20° 58′ N.; long. 120° 03′ E. 180 fathoms. 4 p. m. Bot. temp. 36.2°; dens. 1.02574. 3 specimens.

August 3, 1909. Mahinog, Camiguin Island, between Leyte and Mindanao. (About lat. 9° 07′ N.) 12–20 feet. 6.30 a. m. 1 specimen.

D. 5616. November 22, 1909. Off Tifore Island, Molucca Passage. Lat. 0° 36′ N.; long. 126° 52′ 20″ E. 20–30 feet. 6.44 p. m. Surf. temp. 84°. 4 specimens.

28. STYLOCHEIRON ABBREVIATUM G. O. Sars.

D. 5320. November 6, 1908. China Sea. Lat. 20° 58′ N.; long. 120° 03′ E. 1804 fathoms. 2.25 p. m. Bot. temp. 36.2°; dens. 1.02574. 7 specimens.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. 1 specimen.

D. 5457. June 8, 1909. Off Legaspi Island, east coast of Luzon. Lat. 13° 12′ N.; long. 123° 49′ 40″ E. 146 fathoms. 9.40 a. m. 2 specimens.

D. 5422. March 30, 1909. Off Lusaran Point. Lat. 10° 31′ N.; long. 122° 18′ 45″ E. Surface. 7.17 p. m. Surf. temp. 82°. 7 specimens.

D. 5233. May 7, 1908. Off Limasaua Island. Lat. 10° 00′ 22″ N.; long. 124° 45′ 06″ E. 100 fathoms. 9 p. m. 9 specimens.

D. 5500. August 4, 1909. Off Macabalan Point. Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°; bot., 53.5°. 6 specimens.

29. STYLOCHEIRON MAXIMUM H. J. Hansen.

D. 5288. July 22, 1908. Off Matacot Point, Luzon. Lat. 13° 43′ 30″ N.; long. 121° E. 115 fathoms. 8.14 a. m. 2 specimens.

D. 5500. August 4, 1908. Off Macabalan Point., Mindanao. Lat. 8° 37′ 45″ N.; long. 124° 36′ 45″ E. 200 fathoms. 11.25 a. m. Surf. temp. 84°; bot. 53.5°. Many specimens.

EXPLANATION OF PLATE 83.

Euphausia fallax.

Fig. 1*a*. Male copulatory organ of first left pleopod, unrolled and seen from behind; × 42.

1*b*. Inner and median lobes of the organ shown in fig. 1*a*, from behind; × 64. p^2, terminal process; p^3, proximal process; p^4, lateral process.

1*c*. Inner and median lobes of the same organ, from the inner side; × 64. The lettering as in fig. 1*b*.

1*d*. Distal part of the terminal (p^2) and the proximal process (p^3) of the same organ, from the inner side; × 100.

Nematoscelis lobata.

Fig. 2*a*. Anterior part of carapace, eyes, and the proximal half of the antennular peduncles of an adult female, from above; × 13.

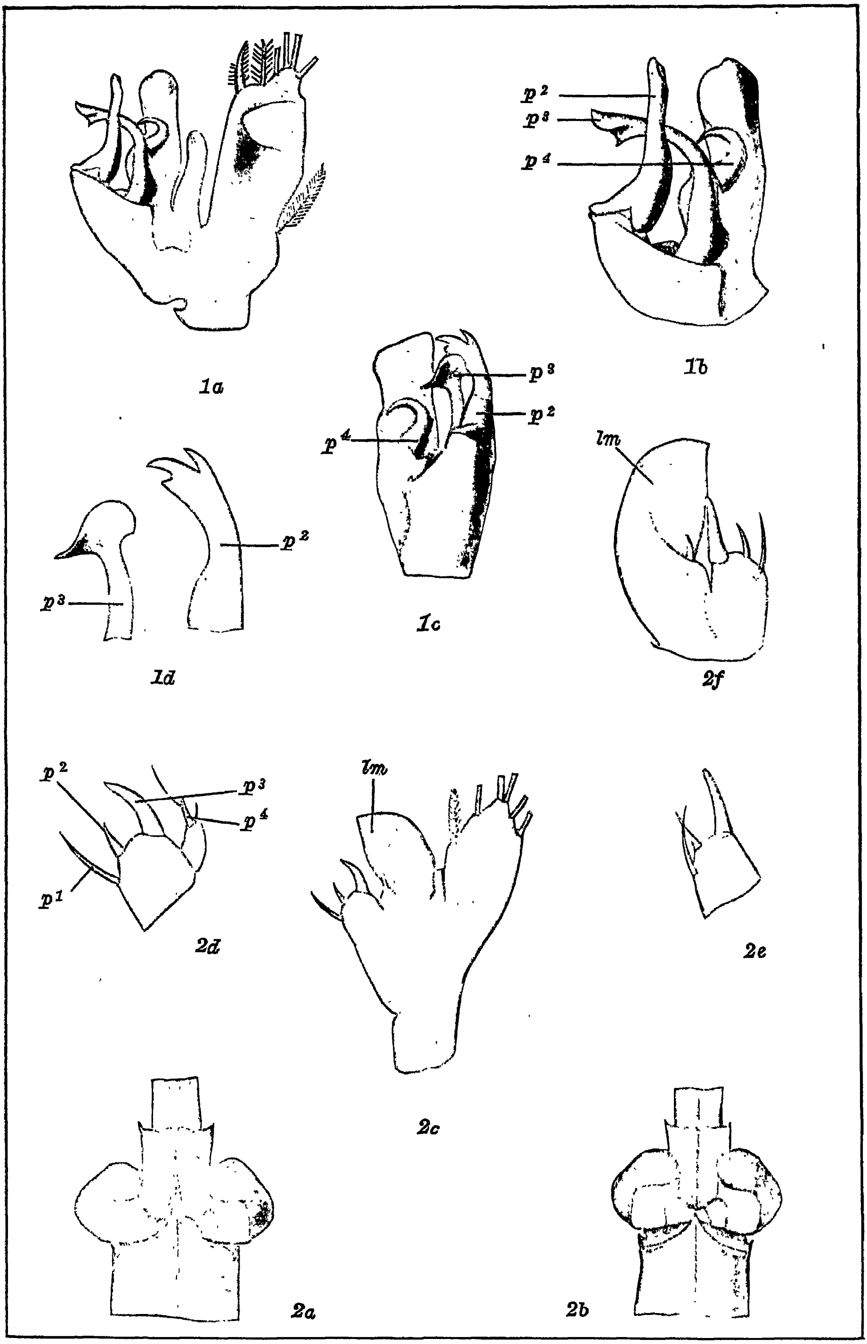
2*b*. Anterior part of carapace, eyes, and the proximal half of the antennular peduncles of an adult male, from above; × 13.

2*c*. Male copulatory organ of first left pleopod, unrolled and seen from behind; × 64. *lm*, median lobe.

2*d*. Inner lobe and proximal inner part of the median lobe of the organ shown in fig. 2*c*, from behind; × 105. p^1, spine-shaped process; p^2, terminal process; p^3, proximal process; p^4, lateral process.

2*e*. Inner lobe of another organ; × 105.

2*f*. Inner and median (*lm*) lobe of a third organ, from in front; × 105.



EUPHAUSIACEAN CRUSTACEANS FROM THE PHILIPPINE ISLANDS.

FOR EXPLANATION OF PLATE SEE PAGE 654.

THE GENERA OF THE TETTIGINIID INSECTS OF THE SUBFAMILY RHAPHIDOPHORINAE FOUND IN AMERICA NORTH OF MEXICO.

By A. N. Caudell,

Of the Bureau of Entomology, United States Department of Agriculture.

The subfamily Rhaphidophorinae is represented in the United States and Canada by 12 genera. Many changes in the classification of the group have been made since the revisional work of Scudder, and the present nomenclature is quite different from that of Scudder's catalogue of 1900. One new genus and several new species have appeared since the beginning of the new century, and the present paper, which is based primarily on material in the United States National Museum, adds two more genera and seven species.

Besides the material in the United States National Museum there has been studied material from the Hebard collection, in Philadelphia, kindly loaned by the owner, and free access has been accorded the writer to the rich collections of the Academy of Natural Sciences in Philadelphia and of the Museum of Comparative Zoölogy in Cambridge, Massachusetts.

The only revisional work done on the Nearctic genera of Rhaphidophorinae was by Scudder in 1894,[1] where keys to the genera and species as then known are given. The group was not considered by Scudder as of subfamily rank, a standing now quite generally conceded, but was designated by him as a section of Stenopelmatinae, as was previously done by Brunner in his general monograph.[2]

In studying the structure of the posterior tibiae in the Rhaphidophorinae it is well to remember that there are three apical calcars on each side—one short ventral one, a longer median one, and an upper one. This upper calcar is sometimes wholly dorsal, and when, as is sometimes the case—as, for example, in *Rhachocnemis*—it is directed upward instead of more or less backward, as usual, there is little or nothing to distinguish it from the dorsal spurs. In such cases care must be taken to not mistake this upper calcar for a dorsal spur.

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[1] Proc. Acad. Arts and Sci., vol. 30, pp. 17-32.

[2] Verhandl. k. k. zool. bot. Ges., vol. 38, 1888, pp. 247-394, pls. 5-9.

Some writers term the apical dorsal spurs, as herein used, the upper calcars and the smaller lower calcars they call ventral spines. The nomenclature of the typical hind tibial armature as used in the present paper is explained in figure 1.[1] This type of armature, however, especially as relating to the dorsal spurs, belongs only to *Ceuthophilus* and its closer relatives, i. e., *Pristoceuthophilus*, *Phrixocnemis*, *Rhachocnemis*, *Udeopsylla*, *Daihinia*, and *Hemiudeopsylla*. In these genera there are generally five pairs of dorsal movable spurs, but sometimes there are six or seven. The remaining genera of the group, *Tropidischia*, *Hadenoecus*, *Diestrammena*, *Cnemotettix* and *Gammarotettix*, have a different type of armature, the dorsal spurs being more numerous and, except in *Hadenoecus*, inarticulate and not strongly differentiated by greater size from the smaller dorsal spines or serrations.

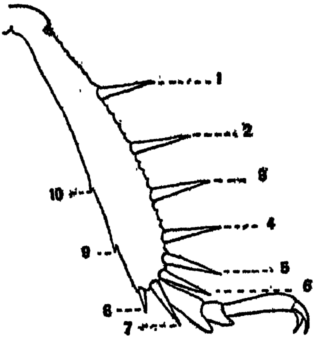

FIG. 1.—FIGURE SHOWING THE DORSAL SPURS, APICAL CALCARS, AND VENTRAL SPINES OF A TYPICAL HIND TIBIA. 1-5, DORSAL SPURS; 6-8, APICAL CALCARS; 9-10, VENTRAL SPINES.

The supraanal plate in the male is usually more or less concealed beneath the last dorsal segment of the abdomen, which is often somewhat produced and sometimes apically cleft.

The genera comprising this subfamily of apterous katydids may be separated by the following key:

KEY TO THE NEARCTIC GENERA OF RHAPHIDOPHORINAE.

1. All the tibiae square in transverse section and similarly armed above and beneath on both outer and inner margins with short, heavy, close-set spines of equal length (fig. 2).. *Tropidischia* Scudder.

None of the tibiae at all as described above..2.

2. Basal segment of the hind tarsus truncate posteriorly above, or scarcely at all produced..3.

Basal segment of the hind tarsus produced posteriorly above into a stout spine, or tapering spinelike process (fig. 6)..4.

3. Legs very long and slender, the fore femora more than twice as long as the pronotum; (last palpal segment in dried specimens cleft beneath only apically).
Hadenoecus Scudder.

Legs shorter and stouter, the fore femora less than twice as long as the pronotum..5.

4 Fore and middle femora with a long genicular spine on one or both sides; hind femora as long as, or longer than, the body; second segment of the hind tarsus about as long as the fourth segment exclusive of the claws, two or more times as long as the vertical depths (fig. 3)........................ *Diestrammena* Brunner.

Femora without genicular spines, the hind femora distinctly shorter than the body; second segment of the hind tarsus barely one-half as long as the fourth, scarcely longer than the vertical depths (fig. 6).......... *Gammarotettix* Brunner.

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[1] The drawings illustrating this paper were made by Miss Mary Carmody.

5. Posterior tarsus with four distinct segments.......................................6.
   Posterior tarsus with but three distinct segments (fig. 25)......*Daihinia* Haldeman.
6. Second segment of the hind tarsus scarcely longer than the vertical depths, usually less than twice as long as the third segment (figs. 22–24)......................7.
   Second segment of the hind tarsus distinctly longer than the vertical depths, being usually two times as long as the third segment (figs. 9, 16, 20)................8.
7. Anterior tibiae armed above, about the middle, or a little beyond, on the inner margin with a distinct spine...............................*Udeopsylla* Scudder.
   Anterior tibiae unarmed above except toward the apex.........................9.
8. Vertex between the antennae armed with a declivitous hornlike protuberance (fig. 20); abdomen of the male more or less tuberculate or spinose above, sometimes conspicuously so (fig. 15)..........................*Pristoceuthophilus* Rehn.
   Vertex between the antennae smooth or tuberculate but never with a declivitous hornlike projection as above; abdomen of the male never distinctly tuberculate or spinose above..*Ceuthophilus* Scudder.
9. All dorsal spurs of hind tibiae short and inarticulate .....*Cnemotettix*, new genus.
   Some dorsal spurs of hind tibiae longer and articulate..........................10.
10. Last dorsal spur of the hind tibiae on the inner side separated from the preceding one by a distance two or more times as great as its own width (figs. 22, 23) ......11.
    Last dorsal spur of the hind tibiae on the inner side separated from the preceding by a distance no greater than its own width (fig. 25)....*Rhachocnemis*, new genus.
11. Posterior tibiae armed above, between each pair of movable spurs, with several, usually five or more, acute serrations....................*Ceuthophilus* Scudder.
    Posterior tibiae unarmed above between the dorsal spurs, or armed with but a few tubercles or serrations, rarely with as many as five tubercles between one or two pairs of spurs, never with five or more serrations between each pair as in Ceuthophilus (figs. 22, 23)..................................*Phrixocnemis* Scudder.
    Unplaced....................................*Hemiudeopsylla* Saussure and Pictet.

Genus TROPIDISCHIA Scudder.

Tropodischia Scudder, Bost. Journ. Nat. Hist., vol. 7, 1862, p. 440.

This genus differs so radically, especially in the armature of the legs, from all other genera of the subfamily that Scudder quite properly separated it as a distinct group. In general appearance it resembles somewhat *Diestrammena* and *Hadenoecus* but is really allied to neither.

Head moderate, as broad as the front portion of the pronotum; vertex between the antennae forming a pair of rounded-triangular, laterally flattened plates, not widely separated and about as long as the basal height; antennae moderately long and slender; palpi with the terminal segment about twice as long as the preceding one, one-fourth longer than the third, gently enlarged apically and cleft beneath only in the terminal fourth or less. Pronotum noticeably broader posteriorly than anteriorly, the disk smooth and passing gradually into the lateral lobes without a sign of lateral or median carinae; lateral lobes shallow, the lower margins straight and horizontal, no humeral sinus; disk of pronotum broadly rounded anteriorly, posteriorly truncate; meso- and metanotum together about as long as the pronotum and as broad as the pronotum at its posterior margin, the lateral lobes equally deep as those of the pronotum, the lower margins rounded, very broadly so in the matanotum. Legs very long and slender, the anterior femora about three times as long as the pronotum; all tibiae square in transverse section and similarly armed above and below on both outer and inner margins with short heavy close-set spines (fig. 2), the apical calcars short; fore femora without genicular spines, the others with short ones on the posterior side, all of them armed above on the posterior three-fourths on both the outer and inner margin with spines similar in arrangement and structure to those of the tibiae and beneath the hind and middle femora are armed on both margins with short, sharp spines separated by spaces usually as great as, or greater than, their own length, the fore femora similarly armed beneath on the inner margin only, the outer margin unarmed; tarsi slender, naked beneath, sparsely and microscopically pilose above, the second segment of all the tarsi three times as long as deep, the first and second segments of the hind feet prolonged posteriorly above in the form of an elongate heavy spine. Abdomen moderately heavy, as broad as the metathorax; subgenital plate of the male ample, the hind margin entire, rounded, furnished with two small styles consisting of a single bluntly conical segment; subgenital plate of the female broad and apically very broadly and shallowly notched; cerci simple in both sexes, cylindrical and gradually tapering in the female, in the male less tapered apically and longitudinally deeply concave in the apical two-thirds; ovipositor three times as long as the pronotom and moderately heavy, gently curved upward, the tip sharp and unarmed.

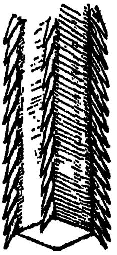

FIG. 2.—TRIPIDISCHIA XANTHOSTOMA. CROSS SECTION OF HIND TIBIA.

The type and only species of this genus is the *Tropidischia xanthostoma* of Scudder, described as *Rhaphidophora xanthostoma* in 1861.[1] Besides the type material of this species from California in the Scudder collection in Cambridge, Massachusetts, the following specimens have been examined:

One female and one nymph from Los Angeles County, California, in the collection of the Academy of Natural Sciences in Philadelphia.

One female from near Hoquiam, in the southwestern part of the State of Washington, in the collection of the United States National Museum.

One male and one female from British Columbia, taken by Harvey Hadden in 1911, in the British Museum in London.

One male from Vancouver Island, British Columbia, taken by E. M. Anderson, March 10, 1913, in collection of the United States National Museum.

The only localities hitherto published for this apparently rare insect are California and Oregon.

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[1] Proc. Bost. Soc. Nat. Hist., vol. 8, p. 12.

Genus HADENOECUS Scudder.

Hadenoecus SCUDDER, Bost. Journ. Nat. Hist., vol. 7, 1862, p. 439.

This genus of long-legged insects, of which *Rhaphidophora subterranea* Scudder is the type, comprises two species which may be separated by the following key:

KEY TO THE SPECIES OF HADENOECUS.

Ovipositor nearly or quite as long as the body; general color pale testaceous; living mostly in caves..................................*subterraneus* Scudder.
Ovipositor considerably shorter than the body; general color dark brown; living mostly in and under the covers of wells........................*puteanus* Scudder.

HADENOECUS SUBTERRANEUS Scudder.

The *Rhaphidophora cavernarum* of Saussure was established in a paper presented in 1860 but not published until January 22, 1862.[1] Scudder's *subterraneus* was published in 1861 and, as the two names have been found to apply to the same species, Scudder's name must be used as it is the earlier. This fact was not understood by Scudder, who sank his own name in favor of that of Saussure, which he dated from 1860 instead of 1862, as is actually the case.

This species has been reported only from caves in the southeastern United States.

HADENOECUS PUTEANUS Scudder.

This species is closely allied to the preceding, but the ovipositor is noticeably shorter and the general color is darker. It seems to occur in and under the coverings of wells and has been recorded from Georgia, Mississippi, and North Carolina. In the Hebard collection in Philadelphia there is a male from Corning, Pennsylvania, taken by Helen Cleland.

Genus DIESTRAMMENA Brunner.

Diestrammena BRUNNER, Verhandl. k. k. zool. bot. Ges., vol. 38, 1888, p. 298.

This genus is represented in our fauna by two species, both introduced. These long-legged, short-bodied insects are not well known in the New World and a somewhat comprehensive description of the genus is therefore here presented.

Head as broad as the anterior portion of the pronotum; vertex between the antennae forming a pair of elongate conical tubercles, about twice as long as the basal width; antennae nearly or quite three times as long as the body and very slender beyond the enlarged first and second segments, the second segment about one-half the length and thickness of the first; palpi long and slender, the apical segment very gently enlarged distally, cleft beneath only apically and

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[1] Ann. Soc. Ent. France, ser. 4, vol. 1, 1862, p. lvi, gives the dates of publication of the various parts of this volume.

nearly twice as long as the third or fourth segments, which are subequal in length. Pronotum slightly broader posteriorly than anteriorly, smooth and evenly rounded above, without sign of median or lateral carinae; lateral lobes distinctly longer than high, the lower margins broadly rounded, the posterior margin with a very broad and shallow humeral sinus; the pronotal disk is subtruncate anteriorly and broadly rounded posteriorly; meso- and metanotum together barely as long as the pronotum but equally as broad, the lateral lobes extending downward as far as those of the pronotum, the lower margins rounded. Legs long and slender, covered with short hairs, or pile; femora unarmed above, beneath unarmed except the posterior ones, which are sparsely armed on the lower inner margin with five or six short stout spines, the outer margin unarmed or armed with one or two spines; fore femora about one and one-half times as long as the pronotum, armed on the posterior side only with a long movable genicular spine; middle femora with a long movable genicular spine on each side; fore and middle tibiae unarmed above, beneath armed with one or two movable spines besides the apical ones; hind tibiae unarmed beneath, above armed on both margins with short close-set spines of subequal length except one pair about the apical fourth which are noticeably longer than the others (fig. 3); the apical tenth or so of the hind tibiae has no spines except one pair at the tip; apical calcars of the hind tibiae long, the upper inner one about as long as the metatarsus, the upper outer one noticeably shorter than the corresponding inner one, the middle inner calcar about one-half as long as the upper inner one, the outer median one less than half as long as the outer upper one; ventral pair of apical calcars equal and short, about one-half as long as the outer median ones. Tarsi slender, the segments unarmed except the posterior metatarsus which

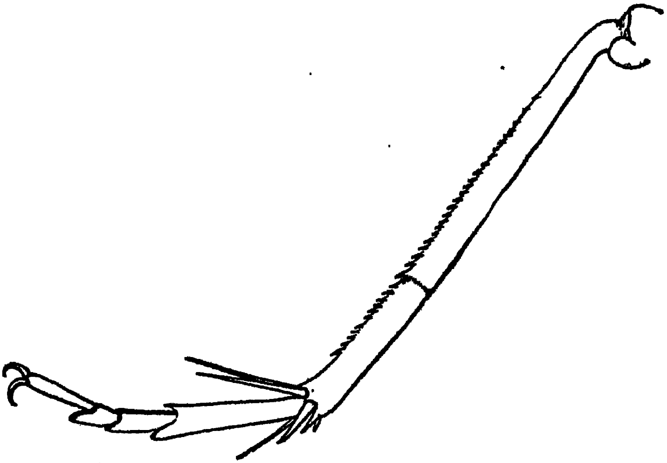

FIG. 3.—DIESTRAMMENA MARMORATA. HIND TIBIA AND TARSUS, OUTER SIDE.

is prolonged posteriorly above as a short sharp spine (fig. 3); second segment of all the tarsi two or more times as long as deep; the tarsi are naked beneath on the second and third segments and the tip of the first, the rest covered with pile, as is the rest of the entire surface. Abdomen gently tapering posteriorly; subgenital plate of the male broad and short, apically truncate, the angles rounded and without styles, the whole plate deeply concave and often closing back over the tip of the abdomen like a lid; subgenital plate of the female subquadrate, narrowing behind, the apical margin triangularly notched; cerci simple, cylindrical, long and slender, tapering to a fine slender point; ovipositor about twice as long as the pronotum, gently curved upward in the apical half, the inner valves serrate apically beneath.

Of the two species of this genus represented in the fauna covered by this paper but one is at all well established. This is the *Diestrammena marmorata* of Haan, the type of the genus. This species has been recorded from greenhouses in Minnesota and Colorado and there are a number of both sexes in the United States National Museum from greenhouses in Springfield, Ohio, and Chicago, Illinois. The female specimen from Kansas recorded by Isley as probably *Ceuthophilus latens* Scudder[1] is really the present species and is the only record of this insect having been taken in this country outside of a greenhouse, this one having been collected outdoors near a sidewalk. The fragmentary and partially decayed condition of this single specimen made this doubtful determination, of which the present writer alone was responsible, almost if not quite excusable.

While the above species seems to be a fairly constant visitor with us, the second species, *Diestrammena unicolor* Brunner, is of rare occurrence, having been reported[2] but once, by A. P. Morse from greenhouses in Chicago, Illinois.

Genus GAMMAROTETTIX Brunner.

Gammarotettix BRUNNER, Verhandl. k. k. zool. bot. Ges., vol. 38, 1888, p. 304.

In this genus the legs are unusually short, the posterior femora being scarcely more than one-half as long as the insect itself. It is more closely allied to the short-legged species belonging to the following genera than to those belonging to the genera described above, but is very distinct from all. A fairly full description of this genus follows:

Head rather small, as broad as the anterior portion of the pronotum; vertex between the antennae forming a pair of tubercles about as long as the basal breadth and separated from each other by a distance as great as the length of one of them; antennae slender, the basal segment large and broad, vertically flattened; palpi very short, the

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[1] Publ. Kans. Acad. Sci., 1905, p. 247.

[2] Psyche, vol. 11, 1904, p. 80.

terminal segment less than four times as long as the apical width, where it is considerably expanded and entire, not ventrally cleft; fourth segment of the palpi about one-half as long as the fifth, the third a little longer than the fourth, the first and second subequal in length with the fourth. Pronotum moderately broadening posteriorly, evenly rounded dorsally, wholly without carinae, fore and hind margins truncate, the lateral lobes longer than high, the sides parallel, without humeral sinus, the lower margin horizontal and very broadly rounded; meso- and metanotum together somewhat longer than the pronotum and slightly broader, the lateral lobes descending a little lower than those of the pronotum, the lower margins rounded and somewhat ascending posteriorly. Legs very short, the fore femora no longer than the pronotum and the posterior ones scarcely or barely reaching the tip of the abdomen; femora unarmed above and below, without genicular spines; fore and middle tibiae unarmed above and below except apically, the hind tibiae unarmed beneath but armed above on both margins for nearly the entire length with short spines of two grades, about every other spine being somewhat shorter than the others; apical calcars short, the longest barely longer than the longest of the dorsal spurs; tarsi short, the second segment of none of them longer than deep; posterior metatarsus produced above into a tapering pointed process about as long as the second segment (fig. 6). Abdomen large and plump, scarcely tapering posteriorly; subgenital plate of the male sunquadrate, apically sinuate by ventral sulcation, without styles; last dorsal segment; of the male cleft nearly to the base; subgenital plate of the female about as broad as long and apically divided into three pointed lobes; supraanal plate of the male nearly hidden beneath the last dorsal segment; of the female roundly triangular, centrally depressed above; carci of both sexes simple, cylindrical and very short and stout, straight in the female, in the male straight or recurved; ovipositor short, about as long as the pronotum, and stout, conspicuously armed below on the inner valves and above on the outer ones, which are moderately curved upward and slightly longer than the lower ones; the true inner valves are here as long as the true lower ones, usually called the inner ones, and unarmed.

Two species comprise this genus, *bilobatus* Thomas, the type of the genus, and *genitalis* new species, described herein. These two species may be separated as follows:

KEY TO THE SPECIES OF GAMMAROTETTIX.

Cerci of male straight, about three times as long as the basal width (fig. 4); subgenital plate of the male with a transverse black band; subgenital plate of the female divided into three somewhat slender fingers (fig. 5)............. *bilobatus* Thomas.

Cerci of the male curved backward and more than three times as long as the basal width (fig. 7); subgenital plate of the male unicolorous; subgenital plate of the female divided into three shorter triangular teeth (fig. 8)....*genitalis*, new species.

GAMMAROTETTIX BILOBATUS Thomas.

This species was described in the genus *Ceuthophilus* by Thomas in 1872, and more than a decade later it was redescribed by Brunner as a new genus and species under the name *Gammarotettix californicus*. Brunner's genus is good and stands, but his specific name falls before the older name *bilobatus* of Thomas. There is no question of this synonymy.

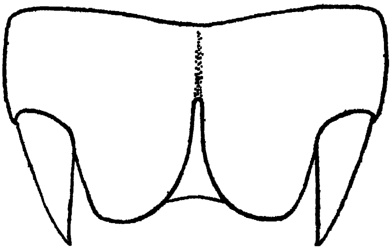

FIG. 4.—GAMMAROTETTIX BILOBATUS. LAST DORSAL SEGMENT OF THE ABDOMEN AND THE CERCI OF THE MALE.

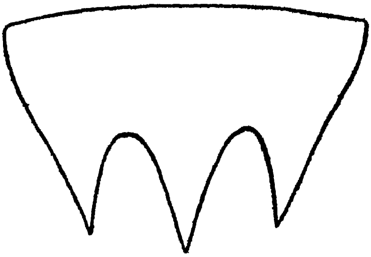

FIG. 5.—GAMMAROTETTIX BILOBATUS. SUBGENITAL PLATE OF THE FEMALE.

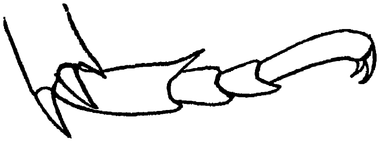

FIG. 6.—GAMMAROTETTIX BILOBATUS. HIND TARSUS.

This species is known only from California but is recorded from various localities in the southern and middle portions of that State, and there are specimens in the United States National Museum from Humboldt County, in northern California. Some specimens from southern California recorded as this species very likely belong to the very distinct species described below.

GAMMAROTETTIX GENITALIS, new species.

This species, which superficially resembles very closely the above, passed the scrutiny of Mr. Scudder without being recognized as a distinct species. But, as indicated by the genital characters cited in the above key, it is amply distinct from *bilobatus*. In addition to the diagnostic characters mentioned in the table, this species differs from *bilobatus* as follows: The last dorsal segment of the male (fig. 7) is more broadly notched posteriorly and distinctly different in shape from that of *bilobatus* (fig. 4); in addition to the difference in color of the subgenital plate of the male, there are other colorational differences deserving mention, thus the diagonal infuscation of the meso- and metanotum, usually a conspicuous feature of *bilobatus* and rarely

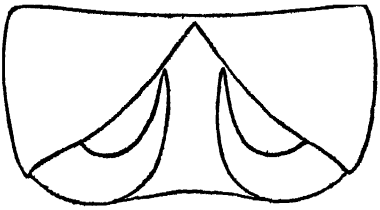

FIG. 7.—GAMMAROTETTIX GENITALIS. LAST DORSAL SEGMENT OF THE ABDOMEN AND THE CERCI OF THE MALE TYPE.

wholly obliterated in that species, seems to be absent in *genitalis;* at least it is not represented in the material studied. The surface of the fastigium of the vertex between the fastigial tubercles is almost invariably blackish in *bilobatus*, while in the present species it is concolorous with the rest of the vertex.

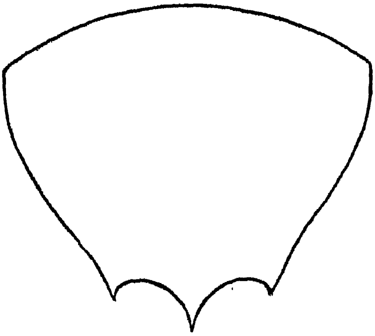
FIG. 8.—GAMMAROTETTIX GENITALIS. SUBGENITAL PLATE OF THE FEMALE TYPE.

Length, pronotum, male, 3 mm.; female, 3.5 mm.; posterior femora, male, 8 mm.; female, 8.5 mm.; ovipositor, 5 mm.; width, pronotum posteriorly, male and female, 4 mm.; hind femora at widest part, male and female, 2.25 mm.

Holotype.—Male, Los Angeles County, California, July; allotype, female, same locality, June. Holotype and allotype in United States National Museum. Catalogue No. 19407. These specimens are listed by Scudder[1] as *G. bilobatus*, and the specimens recorded at the same time from San Diego, California, will very likely be found to belong to this new species.

GENUS CEUTHOPHILUS Scudder.

Ceuthophilus SCUDDER, Can. Nat., vol. 7, 1862, p. 284; Proc. Amer. Acad. Arts Sci., vol. 30, 1894, p. 23.

Machamala WALKER, Cat. Derm. Salt. Brit. Mus., vol. 2, 1869, p. 209.—KIRBY, Syn. Cat. Orth., vol. 2, 1906, p. 130.

This, the dominant genus of the group, contains a large number of species as now considered, though there is very likely some synonymy among them. It is difficult to distinguish nymphs from adults and this will probably prove to be the cause of some duplication of specific names when the members of the genus are better known. In fact, this is already proven by the reference, on a later page of the present paper, of *Ceuthophilus henshawi* Scudder to the synonymy under *Pristoceuthophilus celatus* of the same author.

The more important differentiating characters of the species of this genus pertain mostly to the male sex, and these sometimes differ in immature and adult individuals. Thus the curved hind tibiae of the adult of some species are straight in immature specimens. Variation in the more available synoptic characters also contributes to the difficulties of a satisfactory classification.

No attempt is made in the present paper to construct a key to the species of this genus. The only comprehensive key published is that by Scudder,[2] and that is quite inadequate for the separation of the

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[1] Proc. Amer. Acad. Arts Sci., vol. 30, 1894, p. 111.

[2] Idem, p. 23.

forms treated. A modern worker with the material of the larger American collections assembled temporarily before him for study of types and other authentic specimens might succeed in constructing a functional key. The following characters seem promising for use in a task such as the above: Structure of the vertex, whether flat or conical; structure of the cerci of the male, which in a few species are very remarkable (fig. 10); the structure of the subgenital plate of the male, the presence or absence of subgenital styles; the ovipositor, whether the inner valves are armed ventrally with more or less slender subapical teeth and furnished at the tip with an apical hook, or without apical hook and unarmed ventrally or furnished only with triangular serrations or undulations; the second segment of the hind tarsus, whether longer or shorter than the depths. A Mexican species, *C. macropus* Rehn, has the basal three segments of the posterior tarsi prolonged posteriorly above as a distinct spine-like projection.

The few species of *Ceuthophilus* in which the second segment of the hind tarsus is barely or no longer than deep, occasionally probably even slightly shorter than deep, are separable from the species of the genus *Phrixocnemis* only by the presence of several small teeth between each pair of large dorsal spurs of the hind tibiae.

The type of *Machamala* Walker, in the British Museum, has been examined and found to be a true *Ceuthophilus*. Kirby was evidently correct in relegating this species to the synonymy under *Ceuthophilus maculatus* Harris, the type of *Ceuthophilus*.

Following are remarks on the synonymy, etc., of some of our native species of this genus:

CEUTHOPHILUS NEOMEXICANUS Scudder.

The male specimen in the collection of the United States National Museum selected as the holotype of this species by Rehn and Hebard [1] is a member of the genus *Phrixocnemis* as used in the present paper, and is therefore included in that genus. The female specimen in the same collection, the only specimen of that sex included in the original description and therefore the allotype, is not congeneric with the holotype but is a true *Ceuthophilus*. If it is a distinct species or a snynonym of another, is an unsolved question. It has five or more serrations between the dorsal spurs of the posterior tibiae and the second segment of the hind tarsus is distinctly longer than deep except in the left leg, which is deformed, where it is about as long as deep.

CEUTHOPHILUS VINCULATUS Scudder.

This species is very close to *californianus*. The types have been examined and material of both species, named by Scudder, are in the collection of the United States National Museum. The character used as diagnostic by Scudder, the presence or absence of raised points on the hind femora of the male, is not constant in authentic material named by him and the differentiating characters mentioned in his descriptions are very slight, the length of the ovpositor being apparently the only discernable difference.

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[1] Proc. Acad. Nat. Sci. Philad., 1912, p. 72.

CEUTHOPHILUS ALPINUS Scudder.

This species is also very close to *californianus* and in both these species as well as in *vinculatus*, *nodulosus* and a new species herein described as *C. genitalis*, and perhaps others, the second segment of the hind tarsus is no longer, or barely longer, than the vertical depths.

CEUTHOPHILUS GRANDIS Scudder.

This is inseparable from *C. gracilipes* Haldemann.

CEUTHOPHILUS STYGIUS Scudder.

This is but a variety of *gracilipes*, the only separating character seeming to be the proportional length of the legs and the armature of the hind femora, characters useless in this instance through variation. Typical *stygius* has the hind femora armed beneath with serrations only while in *gracilipes* they are armed with distinct spines. But a series of specimens shows a gradual variation from one form to the other. *Stygius* has been considered a cave dweller, but some years ago I took specimens beneath stones some distance from caves in Indiana that were inseparable from ones taken within the Wyandotte cave.

CEUTHOPHILUS ATER Scudder.

This species has a dorsal spine near the middle of the anterior tibiae, proving it a member of the genus *Useopsylla* where it is placed in the present paper, in synonymy under *U. nigra* Scudder.

CEUTHOPHILUS POLITUS Scudder.

This is also a member of the genus *Udeopsylla* and a synonym of *U. robusta* Haldemann.

CEUTHOPHILUS CELATUS Scudder.

This is not a *Ceuthophilus* but belongs to the allied genus *Pristoceuthophilus*, where it will be found in the present paper.

The species of *Ceuthophilus* recorded by Scudder from Victoria, British Columbia, as *C. celatus* was not this species, but *C. agassizi* Scudder. This fact was determined by examining a male in the Morse collection from the same catch as the female in the Scudder collection.

CEUTHOPHILUS DEVIUS Scudder.

This species belongs to *Udeopsylla* and is here transferred to that genus.

CEUTHOPHILUS PALMERI Scudder.

This is very likely a composite species, as there is great diversity of size among the type material and the length of the ovipositor ranges from scarcely longer than the pronotum to more than twice as long.

CEUTHOPHILUS TERRESTRIS Scudder.

This species is separable from most if not all of its allies by having the subgenital plate of the male undivided and without styles. This peculiarity is exhibited in a single authentic male specimen in the United States National Museum, and Mr. Rehn called my attention to the same thing in specimens in the collection of the Academy of Natural Sciences in Philadelphia.

CEUTHOPHILUS UHLERI Scudder.

This species has a distinctly conical vertex, approaching the *Pristoceuthophilus* type.

CEUTHOPHILUS SECLUSUS Scudder.

The vertex of this species is also distinctly tubercular, but scarcely so declivitous and hornlike as in *Pristoceuthophilus*.

CEUTHOPHILUS NODULOSUS Brunner.

This is a remarkable species by reason of the brevity of the dorsal spurs and apical calcaria of the posterior tibiae of both sexes and the structure of the last dorsal abdominal segment and cerci of the male. Here the cerci are apically much expanded and inwardly deeply concave, the last dorsal segment is prolonged and shaped in an unusual manner and the subgenital plate is undivided, narrowed

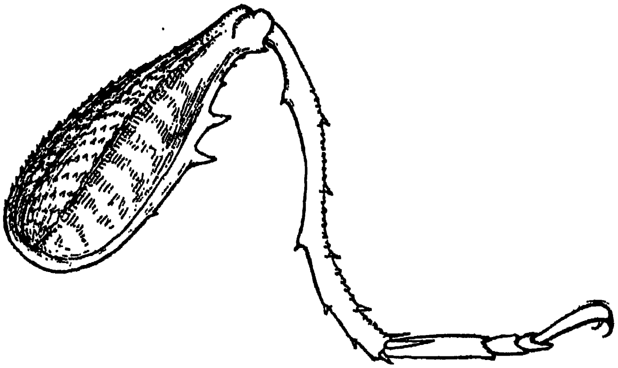

FIG. 9.—CEUTHOPHILUS NODULOSUS. HIND LEG OF MALE TYPE.

apically, the tip rounded and with a subapical construction and without styles. These characters, which are unknown in any other species except the one immediately following, are shown at figures 9 and 10.

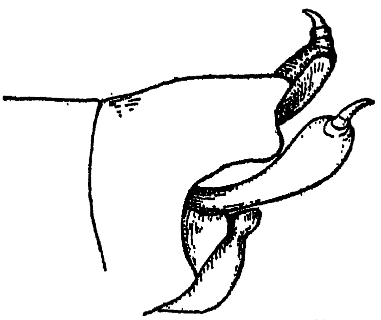

FIG. 10.—CEUTHOPHILUS NODULOSUS. END OF THE ABDOMEN OF THE MALE TYPE.

CEUTHOPHILUS GENITALIS, new species.

Description.—Head as broad as the front portion of the pronotum; vertex with a very broad and but little elevated tubercle; last segment of the palpi nearly twice as long as the preceding one and cleft beneath for most of its length. Pronotum slightly and gradually broadening posteriorly, the lower margin of the lateral lobes very broadly rounded, the anterior angle a little more rounded than the posterior one; meso- and metanotum as broad as the pronotum but, with the abdominal segments, tapering uniformly posteriorly; lateral lobes descending scarcely lower than those of the pronotum, the lower margins rounded. Abdomen with a few very minute inconspicuous granular tubercules scattered sparsely over the dorsal surface, visible only when examined under a lense; last dorsal abdominal segment and the cerci of the male essentially as figured under *C. nodulosus*, the preceding species, the anal segment a little more truncate apically; the subgenital plate of the male is also practically like that of *nodulosus*, being considerably constricted subapically, and then broadening to an apically rounded slightly transverse plate which, however, instead of being entire as in *nodulosus*, is apparently divided for fully half its length by a closed cleft, though this may be merely a fold, as it is very obscurely visible in the unique male studied; cerci of female simple, closely segmented and tapering. Ovipositor of same length as the ponotum, the inner valves armed apically beneath with teeth three or more times as long as the median width and with a terminal down-curved hook, the outer valves unarmed except with a terminal up-curved hook. Legs short; femora without genicular spines; fore femora about same length as the pronotum, armed beneath only with a single subapical spine on the inner margin; middle femora about as long as the anterior ones and very slightly more slender, armed beneath on both sides with a few short spines; hind femora about twice as long as the pronotum and stout, about one-third as broad basally as the entire length, tapering to near the apex and armed beneath on both margins in the female and on the inner margin in the male with acute triangular serrations, the lower outer margin in the male armed with four or five stout spines; the hind femora of the male has several minute acute tubercles on the dorsal surface; fore tibiae unarmed above, beneath with three pairs of moderate sized spines in addition to the apical ones; middle tibiae armed above with two or three spines on each side, beneath as in the anterior ones; hind tibiae nearly straight in both sexes, very slightly curved in the male, the dorsal spurs decidedly shorter than the tibial depths, the interspural serrations acute and seldom less than five between each pair of spurs; dorsal apical calcar on the inner side about twice as long as the apical dorsal spur, distinctly longer than the tibial depth, on the outer side not so long as on the inner side; median apical calcar slightly longer and considerably thinner than the ventral one, about the same size and length as the apical dorsal spur; beneath the hind tibiae are armed with three mesially located spines and usually a horizontal subapical pair, all on the apical half of the tibia; in the male there is a noticeable subbasal hump beneath the hind tibiae as illustrated in the figure of the posterior leg of *Ceuthophilus nodulosus* (fig. 9), but less prominent; all tarsi with the second segment short, barely or no longer than deep, a little more than twice as long as the third segment.

Color shining yellowish brown, slightly darker above, especially on the abdomen.

Length, both sexes, pronotum, 3.75 mm.; fore femora, 4 mm.; hind femora, 9.5 mm.; ovipositor, 3.75 mm.; width, hind femora at widest point, 3 mm.

Holotype.—Male, Queen, New Mexico, November 7, 1914. E. G. Holt, collector; allotype and paratype, female, same data as the holotype.

Holotype and allotype in United States National Museum. Catalogue No. 19413. Paratype in collection of Morgan Hebard in Philadelphia.

This species is structurally closely allied to *Ceuthophilus nodulosus* but superficially scarcely at all resembles that species. The smaller size, the apparently more compact form, and the nearly straight posterior tibiae of the male will serve to distinguish this new species from *nodulosus*. In *nodulosus* also the ventral spines of the hind tibiae are situated on more prominently elevated tubercles than in *genitalis* and the subbasal ventral hump is somewhat more prominent.

The short stout form and shining color of *genitalis* together with the short legs remind one of some species of *Phrixocnemis* and the short second segment of the tarsi shows a relationship with that genus.

If it were the accepted custom to base genera on purely secondary sexual characters, *nodulosus* and *genitalis* would deserve separation from *Ceuthophilus*, for the males of those species are certainly anomalous for that genus.

Genus PRISTOCEUTHOPHILUS Rehn.

Pristoceuthophilus Rehn, Trans. Amer. Ent. Soc., vol. 29, 1903, p. 17.

This genus is a development of *Ceuthophilus* and its divergence from that type is not sufficient to mark it a strongly characterized genus. The main differentiating character is the development of the fastigium of the vertex into a distinct acuteangulate hornlike projection directed forward and more or less downward. An important secondary sexual character is furnished by the dorsum of the abdomen of the male, which is ornamented by several more or less elevated tubercles or blunt spines, and sometimes with a few conspicuous smooth elevated areas (fig. 15). The unique type of the genus, *P. rhoadsi* of Rehn, an unique male from Mexico, has scarcely a trace of any dorsal roughness and the young stages of all the species, even those in which the dorsal armature is conspicuous in the adult, show few or no dorsal tubercles or elevations, especially in the earlier instars.

As a constant character in this genus, so far as known, is the inner valves of the ovipositor being furnished apically beneath with more or less rounded triangular serrations only, sometimes scarcely more than undulations, and without an apical hook. In *Ceuthophilus* the above is true only of immature specimens and of a portion only of the species in the adult form, the rest having the ovipositor armed beneath with several more or less slender subapical teeth and furnished at the tip with an apical hook.

There are seven species now referred to *Pristoceuthophilus* and other species now in *Ceuthophilus* may eventually be found to belong here. But in this connection it is well to observe carefully the fastigium of the vertex, the dorsal surface of the abdomen in the male and the ovipositor of adult females. If the vertex is smooth or furnished only with a tubercle, if the abdomen of the male is smooth above, or if the inner valves of the ovipositor of the adult is armed below with a slender subapical tooth or furnished with an apical hook, then the specimen is a *Ceuthophilus*. But if the vertex is developed into a hornlike declivitous projection, the abdomen of the male furnished above with tubercles or spines, or, usually, if the ovipositor of the adult female is unarmed beneath or furnished only with more or less rounded serrations or undulations and without an apical hook, then the specimen is a *Pristoceuthophilus*.

KEY TO THE SPECIES OF PRISTOCEUTHOPHILUS (*based on the male*).

1. Dorsal surface of the abdomen with tubercles or spines and also with some elevated smooth areas.. 2.

Dorsal surface of the abdomen without elevated smooth areas................. 3.

2. Dorsal surface of the abdomen with numerous rounded tubercles and four or five large elevated smooth areas, none of which are more than one-half as high; as broad; cerci as in figures 13 or 14...................... *celatus* Scudder.

Dorsal surface of the abdomen with numerous stout blunt spines and four elevated smooth areas, some of which are higher than broad (fig. 15); cerci as in figure 17 .... *tuberculatus* Caudell.

3. Cerci as in figure 14 .... *celatus* Scudder. (*nymph*).

Cerci as in figure 17 .... *cercalis*, new species.

Cerci not as in either of the above .... 4.

4. Posterior femora armed beneath on the outer carina with distinct spines, or shaped as in figure 20 .... 5.

Posterior femora armed beneath on the outer carina with serrations only, the serrated margin often terminating apically in a more or less elongate spinelike angle (fig. 18), *never as in figure 20* .... *marmoratus* Rehn.

5. Roughness of the dorsal surface of the abdomen consisting of a few small blunt tubercles situated mostly along the posterior borders of the segments commencing with the second or third from the base; color shining dark brown .... *salebrosas* Scudder.

Roughness of the dorsal surface of the abdomen consisting of tubercles as above but present on all the segments and more generally distributed; color opaque yellowish brown .... *pacificas* Thomas.

PRISTOCEUTHOPHILUS CELATUS Scudder.

Ceuthophilus celatus Scudder, Proc. Amer. Acad. Sci. Arts, vol. 30, 1894, p. 48.
Ceuthophilus henshawi Scudder, Proc. Amer. Acad. Sci. Arts, vol. 30, 1894, p. 97.

Of the synonymy of *henshawi* with *celatus* there is no doubt. The somewhat extensive series taken by the writer in British Columbia in 1903 and recorded as *henshawi* in the genus *Marsa* contained numbers of immature specimens of various sizes, some of the larger of which agree perfectly with the types of *celatus*, a fact not noticed until recently. It is unfortunate that the name *henshawi*, based on adult material, has to fall in synonymy under that of *celatus*, based on immature specimens, but accepted rules of nomenclature permit no other course.

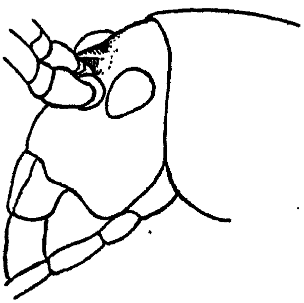

FIG. 11.—PRISTOCEUTHOPHILUS CELATUS. HEAD, SHOWING THE VERTICAL HORN.

In this species the vertical cone is typical (fig. 11) and the dorsal surface of the abdomen of the immature male shows but a few scattered tubercles, very little elevated but distinct, but in the adult male these tubercles are very numerous and well elevated and in addition there are four or five transverse, smooth elevated areas about half as high as thick; in the full grown nymphs these elevated smooth areas are sometimes distinctly present but never conspicuous as in the adult. The structure of the cerci of the immature male differs decidedly from that of the adult; in the adult the cerci are scarcely less remarkable in form than those of *cercalis* and *tuberculata*, but very different. The cerci of the adult male is shown at figure 13 and that of the nymph at figure 14. The posterior femora is ampliate beneath and furnished with serrations only, the termination of the ampliation sometimes forming a spinelike angle (fig. 12).

In addition to authentic material named by Scudder from California and the series taken by the writer at Kaslo, British Columbia, the United States National Museum collection contains an immature pair from Dunsmuir, California, collected July 20, 1906, by Dyar and Caudell and formerly recorded as *Marsa pacifica*.

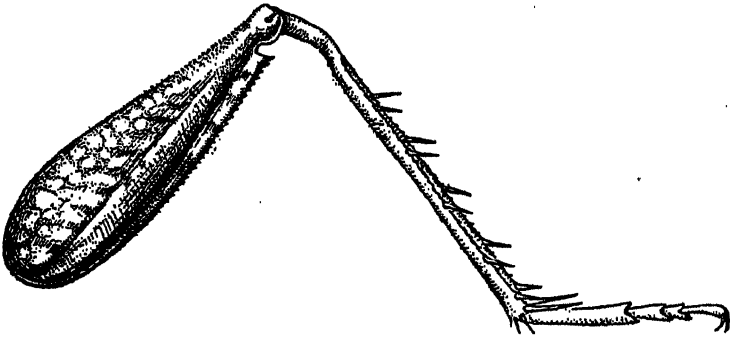

FIG. 12.—PRISTOCEUTHOPHILUS CELATUS. HIND LEG OF ADULT MALE.

A series of two male and four female specimens of this species from the Hebard collection are labeled "Glendale, Douglas County, Oregon; altitude, 1,500 feet, August 12, 1909." These were taken in the Rogue River Mountains and regarding them Mr. Hebard, the collector, writes as follows:

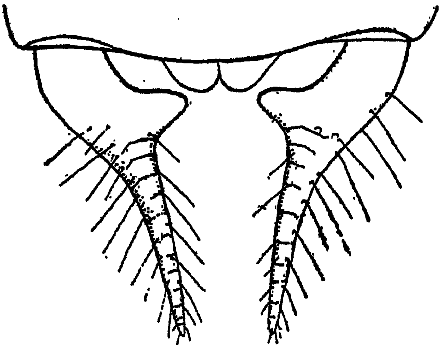

FIG. 13.—PRISTOCEUTHOPHILUS CELATUS. CERCUS OF ADULT MALE.

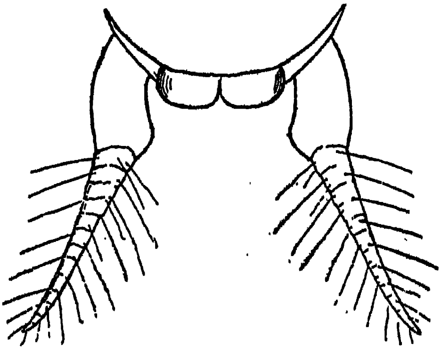

FIG. 14.—PRISTOCEUTHOPHILUS CELATUS. CERCUS OF IMMATURE MALE TYPE.

> Found in two fir stumps under bark and in the large holes of borers in the slightly damp decayed portions of the sapwood. When exposed some remained motionless while others sprang wildly about and then as suddenly remained perfectly quiet. Such individuals were almost impossible to follow and their coloring made them almost indiscernable on the ground, in this way several escaping.

PRISTOCEUTHOPHILUS TUBERCULATUS Caudell.

Marsa tuberculata CAUDELL, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 79.

This species, a very distinct one, has not been referred to since its original description in the genus *Marsa*. The structure of the cerci of the male is essentially like that of *cercalis*, described and figured below (fig. 17). The dorsal surface of the abdomen of the male is characteristic in armature, being furnished with large stout spines and four conspicuous smooth elevated areas, some of which are higher than broad (fig. 15). The hind femora of this species are not distinctly ampliate beneath as in *celatus* but armed about the same as in that species (fig. 16).

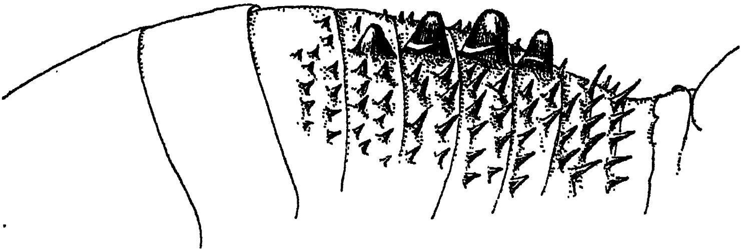

FIG. 15.—PRISTOCEUTHOPHILUS TUBERCULATUS. DORSUM OF ABDOMEN OF ADULT MALE TYPE.

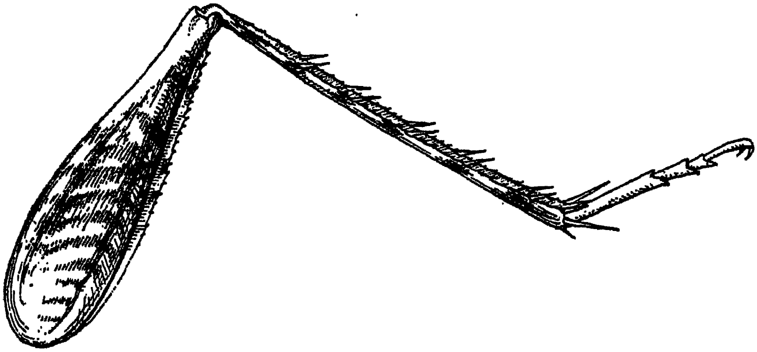

FIG. 16.—PRISTOCEUTHOPHILUS TUBERCULATUS. HIND LEG OF MALE TYPE.

PRISTOCEUTHOPHILUS CERCALIS, new species.

Description.—Head with the frontal horn very well developed, as characteristic of the genus, but scarcely as long and acute as in *celatus* (fig. 11); antennae not very long, apparently but little longer than the insect itself. Thoracic segments smooth in both sexes. Abdomen of the female smooth, of the male with all the segments, except one or two of the terminal retractile ones, densely covered above on the posterior half or more with large rounded tubercles. Legs moderately stout; hind femora unarmed above in both sexes and also beneath in the female except for a few very minute serrations, mostly on the inner margin; in the male the hind femora are armed ventrally on both margins with several distant short sharply pointed triangular serrations, with some much more minute ones between them, and one large spine near the apex. Cerci of the adult male (fig. 17) differing from all other described species except *tuberculatus* in being slightly compressed basally and unsegmented to near the tip, where it is bent slightly inward and latero-apically depressed, from this depression arising a distinctly segmented terminal tapering projection consisting of about four segments; on the inner surface of the slightly inwardly inclined circus proper, at the apex opposite the depression from which the segmented apical portion arises, there is an oval elevated area covered with short pile; the cerci of the immature male are less flattened than in the adult, distinctly segmented only toward the apex and with a slight shoulder at the point where the extreme modification in the adult is located; in the female the cerci are simple, cylindrical, and tapering, distinctly segmented apically. Ovipositor heavy, somewhat longer than the pronotum, the inner valves triangularly serrate apically beneath.

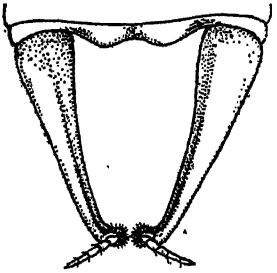

FIG. 17.—PRISTOCEUTHOPHILUS CERCALIS. CERCI OF ADULT MALE TYPE.

Color brown with more or less obscure mottlings of lighter color; ovipositor uniformly reddish brown.

Length, pronotum, male and female, 3 mm.; fore femora, male and female, 4 mm.; hind femora, male, 8.5 mm., female, 9 mm.; ovipositor, 5 mm.

Holotype male.—Yellow Bay, Flat Head Lake, Montana, August 18, 1913, Charles C. Adams, collector; allotype, same data as holotype; paratype *a*, male, *b*, *c*, females, same locality as type but date August 10; *d*, *e*, males, Mount Rainier, Washington, August 22, 1910, at Long Mire's Springs, elevation 7,200 feet; *f*, male, *g*, *h*, *i*, *j*, *k*, *l*, *m*, females, Mount Hood, Oregon, August 18–20, 1910, Cloud Cap trail, altitude, 6,000–7,000 feet, Hebard collector; *n*, male, *o*, *p*, female, Ashford, Oregon, August, 1906, Dyar and Caudell collectors.

The above material is distributed as follows:

Holotype, allotype and paratypes *c*, *e*, *l*, *m*, *n*, *o*, *p* in United States National Museum, Cat. No. 18379; *a*, *b* in collection of the University of Illinois; *d*, *f*, *g*, *h*, *i*, *j*, *k* in collection of Morgan Hebard in Philadelphia.

The paratypic material shows little variation in structure but considerable in size, the largest specimens having a pronotal measurement of 3.75 mm. in the male and 4.5 mm. in the female, while the posterior femora measure 9 mm. in length in the male and 11.5 in the female.

Regarding paratypes *f* to *m*, from Mount Hood, Oregon, Mr. Hebard, the collector, writes as follows:

> In heavy conifer forest 5,300 feet, under stones and bark, many nymphs but adults scarce.

He adds that the specimens from Long Mires Springs, Washington, paratypes *d* and *e*, were taken in dense forest above the hotel, one under a bowlder and one under a log.

Mr. Adams, the collector of the types of this species, writes that all his specimens were taken in woodland areas. Thus it appears as if this insect is partial to deep woodlands.

The eggs of this insect, one of which was taken from paratype *b*, are 2.5 mm. in length, one-half as broad as long and of a uniformly yellowish color.

PRISTOCEUTHOPHILUS MARMORATUS Rehn.

Among material in the United States National Museum determined by Scudder as *Ceuthophilus pacificus* Thomas are four specimens—2 adult males, 1 adult female, and 1 immature female—which belong to this species. The only essential variation noticeable in this material and the type of *marmoratus*, which has also been examined, is the size of the toothlike angle terminating the lammellate ventral edge of the outer margin of the hind femora (fig. 18).

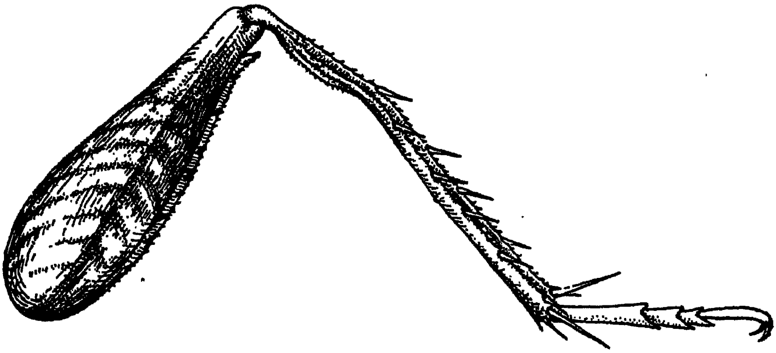

FIG. 18.—PRISTOCEUTHOPHILUS MARMORATUS. HIND LEG.

PRISTOCEUTHOPHILUS SALEBROSUS Scudder.

This species is now referred to the present genus for the first time. It was described from Washington, and there is a specimen referred to this species in the collection of the United States National Museum from San Francisco, California.

This insect is allied to *P. pacificus* Thomas, but the characters given in the above key indicate specific differences.

PRISTOCEUTHOPHILUS PACIFICUS Thomas.

This species is recorded from various places throughout nearly the whole length of California and from Nevada, and there is a male specimen referred to this species in the National Museum from Ainsworth, British Columbia.

There appears to be an unusual diversity of structure in the posterior limbs of the males of this species, indicating indeed a plurality of species. Some males seem to have the posterior femora unusually broad and heavy and armed with a single large tooth and several minute serrations on both ventral margins, as in the type specimen in the United States National Museum (fig. 19); others have these femora heavy, as above, but armed only with small serrations (fig. 20). A single male in the Scudder collection is the only one with this type of femora seen, and it may prove to be a distinct species.

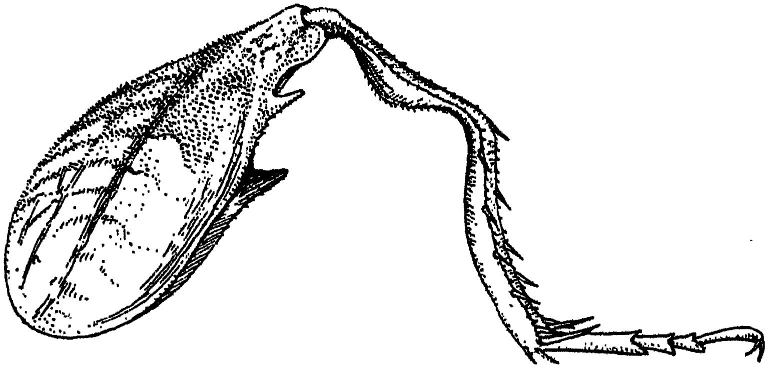

FIG. 19.—PRISTOCEUTHOPHILUS PACIFICUS. HIND LEG OF MALE TYPE.

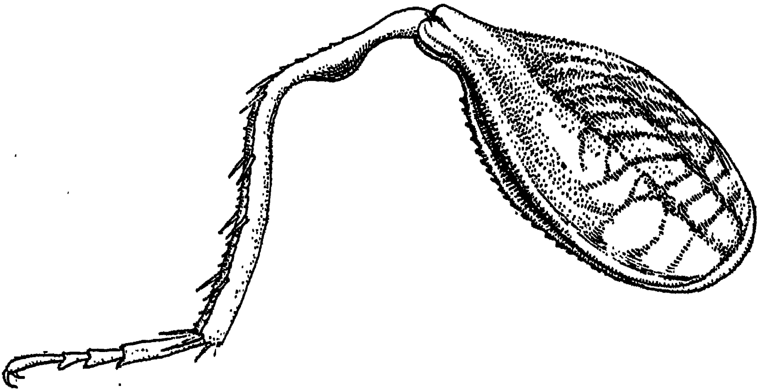

FIG. 20.—PRISTOCEUTHOPHILUS PACIFICUS. HIND LEG OF MALE IN THE SCUDDER COLLECTION.

Genus PHRIXOCNEMIS Scudder.

Phrixocnemis SCUDDER, Proc. Amer. Acad. Arts Sci., vol. 30, 1894, p. 102.

In this genus, the salient characters of which are set forth quite fully in the generic key, there are 10 species here included, 3 new species, 1 transferred from the genus *Ceuthophilus*, 2 from *Udeopsylla*, and 4 originally described in this genus, including *P. truculentus* Scudder, the designated genotype.

The forms referred to *Phrixocnemis* are, for the most part, rather closely allied, and three of them—*socorrensis*, *franciscanus*, and *serrata*—were described by Mr. Rehn from the Snow collection, in Kansas, where the types are deposited. Aside from the three above-mentioned species, the types of all our forms have been studied and the following key drawn up for their separation:

KEY TO THE SPECIES OF PHRIXOCNEMIS.

1. Apical two dorsal spurs of the posterior tibiae about twice as long as the tibial depths and separated from each other by a distance scarcely one-half as great as the length of one of them..........................*longispinosus*, new species.

Apical two dorsal spurs of the posterior tibiae not or but little longer than the tibial depths and separated from each other by a distance about as great as, or greater than, the length of one of them (fig. 22)....................................2.

2. Upper outer calcar of the posterior tibiae apparently one-half or more longer than the tibial depths, by actual measurement fully twice as long.
obesus, new species.

Upper outer calcar of the posterior tibiae apparently not or barely longer than the tibial depths, by actual measurement sometimes as much as one and one-fourth as long..3.

3. Posterior tibiae armed beneath with a single median spine near the tip; posterior femora of the male armed beneath with one or more distinct spines and the corresponding tibiae decidedly bowed.
truculentus Scudder. (? *inhabilis* Rehn.)

Posterior tibiae armed beneath with more than one spine, the apical two situated one on each side of the median line; posterior femora of the male armed beneath with serrations or tubercles only and the corresponding tibiae almost or quite straight..4.

4. Ventral outer calcar of the posterior tibiae not or but little more than one-half as large in general bulk as the median one; the ventral spurs usually correspondingly small..5.

Ventral outer calcar of the posterior tibiae larger, in adults two-thirds or more as large in general bulk as the median one, the ventral spurs correspondingly larger..*vierecki* Rehn.

5. Posterior femora of the male with some minute blisterlike tubercles on the outer face about and just beyond the middle and below the median line; ventral teeth on the outer margin of the hind femora of the male bluntly acute-conical.
oregonensis, new species.

Posterior femora of the male smooth on the outer face, the teeth of the lower outer margin sharply acute................................*neomexicanus* Thomas.

Unplaced................*socorrensis* Rehn, *franciscanus* Rehn, and *serratus* Rehn.

PHRIXOCNEMIS LONGISPINOSUS, new species.

Description.—(Female, the male unknown.) Form moderately robust. Anterior tibiae unarmed above, armed beneath on both margins with four stout movable spurs and apically on each side with a similar spine situated laterally and near the dorsal surface; middle tibiae armed as in the anterior ones, and in addition armed above with three pair of spines similar to the ventral ones; hind tibiae armed beneath on the median line with a couple of small spines on the apical third, above armed with five spines on each margin and with a few smaller serrations between them, the last dorsal spur on the inner side longer than the corresponding dorsal calcar[1] and separated from the preceeding spur by a distance about twice its basal width. Fore femora unarmed above, beneath armed with one or two minute spines on each side; middle femora unarmed above except for a distinct genicular spine on the hind margin, beneath armed with two or three very minute spinules on each margin; posterior femora stout, about three times as long as the greatest width, abruptly tapering in the apical third to near the tip, the upper surface smooth, no raised points, the lower side armed on each margin in the apical part with a few very small backwardly directed, mostly distantly separated, serrations; no genicular spines on the hind femora. Ovipositor very short, about as long as the pronotum, gently upcurved, the teeth of the inner valves long and sharp; cerci about as long as the ovipositor, expanding to the middle of the apical third and from there tapering to the tip, sparsely covered with very long and exceedingly fine hairs.

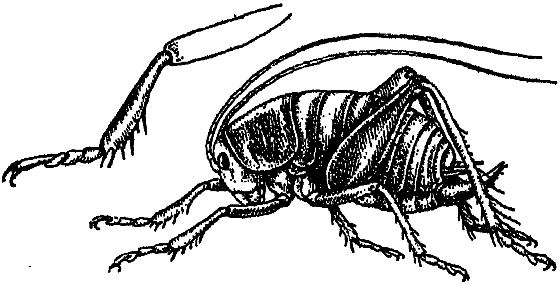

FIG. 21.—PHRIXOCNEMIS LONGISPINOSUS. ADULT FEMALE.

General color yellowish with the sides of the thorax and the upper part of the abdomen and head blackish, the pronotum and mesonotum with a distinct yellowish dorsal stripe.

Length, head to the end of the abdomen, exclusive of the ovipositor, 12.5 mm.; pronotum, 3.5 mm.; fore femora, 4 mm.; hind femora, 9 mm.; ovipositor, 3.5 mm.; width, pronotum through the widest part, 4 mm.; hind femora at widest point, 3.25 mm.

Holotype.—Female, Govan, Washington, August 24, 1911, Mr. Hyslop collector. Type in the United States National Museum, Cat. No. 19461.

The above insect was being carried away by a predaceous wasp, *Larropsis dolosana* Rohwer.

In the long dorsal spurs of the posterior tibiae and in the lesser distance separating the two apical pair this species approaches somewhat the genus *Rhachocnemis*.

Figure 21 shows the holotype of this species.

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[1] This calcar shows some signs of injury, being more abruptly tapered apically than the others, and thus may really be longer than the last dorsal spur, or equally long Only the left hind leg is present, the right one being broken off and lost.

PHRIXOCNEMIS OBESUS, new species.

Description.—(Male, the female unknown.) Form robust; color shining dark brown above, merging into yellowish brown below. Head large and broad, the interocular space twice as broad as one of the eyes; palpi with the fifth segment a little longer than the third. Pronotum slightly broader than long, very broadly rounded above, the anterior margin very slightly and broadly concave, the posterior margin truncate, the lateral lobes with the lower margins nearly straight, the angles evenly rounded; meso- and metanotum together about as long as the pronotum and with the lateral lobes descending about the same distance as those of the pronotum, the lower margins broadly rounded. Abdomen smooth, broad anteriorly and narrowing gradually posteriorly; subgenital plate divided for nearly or quite its entire length; cerci medium in length and bearing numerous very fine long hairs. Anterior femora unarmed on the outer inferior margin, the inner margin armed for nearly the entire length with rounded tubercucles, so densely set as to touch each other at the bases, and subapically with a single short movable spine; middle femora armed beneath on both margins with two or three short stout movable spines and several small triangular teeth; hind femora stout, about two and one-half times as long as the greatest width, armed on both ventral margins with acute teeth, above furnished with a few small acute granules; fore tibiae unarmed above, beneath armed with four moderately long stout movable spurs on each margin, the apical one the longest, and with one apical lateral spur on each side; median tibiae armed like the anterior ones and in addition have a single spur above at the apical third on the anterior side and two on the posterior side, one not quite opposite the one on the other side and one at about the basal third; posterior tibiae straight, with three or four acute triangular teeth between the dorsal spurs, which are about as long as the tibial depths, the apical one separated from the preceding by a distance a little greater than the length of one of them; apical calcars long, the outer ventral one but little less in general bulk than the median one, the upper one a third longer than the median one, being apparently one-third or more longer than the tibial depth, by actual measurement fully twice as long; beneath the hind tibiae are armed with a single preapical spur, situated mesially and of moderate size.

Length, pronotum, 6 mm.; fore femora, 6 mm.; hind femora, 12 mm.; width, hind femora at broadest point, 4.5 mm.

Holotype.—Alameda County, California. In the United States National Museum, Cat. No. 19462.

This specimen was determined by Scudder as *Ceuthophilus californianus*. It is apparently somewhat allied to *serrata* Rehn, but certain characters, especially the armature of the fore femora, seem to sufficiently differentiate it from that species, as described by its author. Nor does it appear to agree with the other species unplaced in the above key.

PHRIXOCNEMIS TRUCULENTUS Scudder.

(?*Phrixocnemis inhabilis* Rehn.)

Phrixocnemis truculentus is the type of the genus, as selected by Rehn and Hebard, and is known to the writer only by the male type in the Scudder collection. The allotypic female is not conspecific with the holotype nor even congeneric, as stated farther on under the treatment of *Rhachocnemis hostiferus* Rehn. The armature of the femora of the male and the distinctly curved hind tibiae of that sex will serve to separate *truculentus* from allied forms. The posterior leg of the holotype is shown at figure 22.

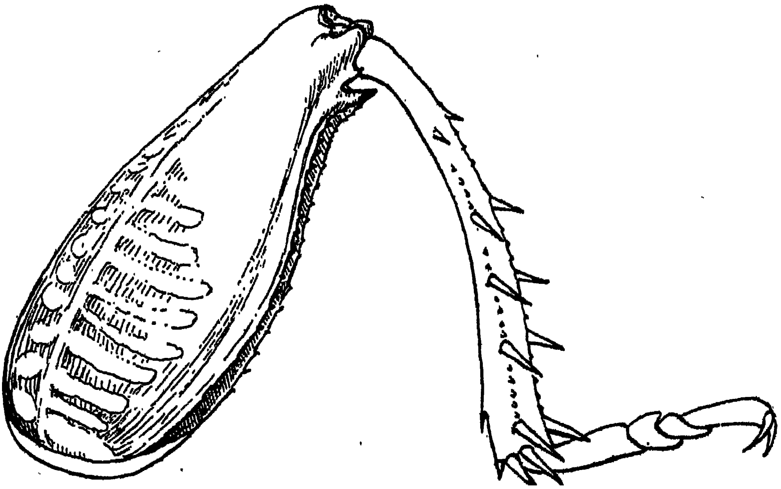

FIG. 22.—PHRIXOCNEMIS TRUCULENTUS. HIND LEG OF MALE TYPE.

Phrixocnemis inhabilis Rehn, known only from the holotype, a female from Missouri in the Hebard collection, is very probably the female of *truculentus* Scudder.

PHRIXOCNEMIS VIERECKI Rehn.

This species was described in the genus *Udeopsylla*, but the absence of a dorsal spine on the fore femora precludes its admission to that genus. The holotype is a badly mutilated specimen found dead in Otero County, New Mexico. Besides this imperfect specimen the following material referred to this species has been examined:

One adult male, very similar to the holotype, Williams, Arizona, June 13. United States National Museum.

Two males, Jamez Hot Springs, New Mexico, July 6, 1911, and October 9, 1913, altitude 6,400 feet, John Woodgate, collector; one female, same data, but dated August 21, 1913. Hebard collection.

One male, New Mexico, the exact locality too poorly written for reading. United States National Museum.

One male, one female, adults, August 14, 1910, one male, one female, nymphs, April 13, 1910, and one female, nymph, July 27, 1910, Fort Wingate, McKinley County, New Mexico, John Woodgate collector. Hebard collection.

Two males, Williams, Arizona, March 31 and July, Barber and Schwarz collectors. United States National Museum.

One female, nymph, Flagstaff, Arizona, July 4, Barber and Schwarz collectors. United States National Museum.

The female is very similar to the male, even as to the armature of of the posterior femora and tibiae. The cerci of both sexes are long and simple and the ovipositor is about as long as the pronotum and the inner valves are armed apically beneath with four long teeth and a terminal hook. The anterior femora have one to three small spines on the lower inner margin, usually one, and the opposite margin unarmed.

There is considerable variation in the size of the specimens examined. A large female in the Hebard collection from Fort Wingate, New Mexico, shows the following measurements: Length, pronotum, 7 mm.; fore femora, 7 mm.; hind femora, 13 mm.; ovipositor, 7 mm. Other adult females are somewhat smaller.

PHRIXOCNEMIS OREGONENSIS, new species.

Description—Male.—Form moderately stout. Color a glistening yellow brown, with faint darker mottling above. Head as broad as the front part of the pronotum, the interocular space twice as broad as one of the eyes; palpi with the fifth segment a little longer than the third. Pronotum about as long as the mesial width, truncate anteriorly and posteriorly, the lateral lobes with the ventral margins nearly straight, the angles uniformly rounded; meso- and metanotum together about as long as the pronotum, the lateral lobes descending about as far as those of the pronotum, the lower margins broadly rounded. Abdomen smooth, tapering posteriorly; subgenital plate apparently broadly notched; cerci long and slender, bearing very fine long hairs. Fore femora without genicular spines, armed beneath on the inner margin only with one to three short movable spurs; middle femora with three or four short movable spurs beneath and a genicular spine on the posterior side only; hind femora about two and one-half times as long as broad, without genicular spines, furnished on the outer face about and just beyond the middle below the median line with some minute blisterlike tubercles, armed beneath on the outer carina in the apical two-thirds with bluntly acute conical teeth, mostly separated by distances about equal to their own basal width, the inner carina similarly armed, the teeth slightly more acute; fore and middle tibiae just as described under *P. obesus*, except the middle ones are armed above with two or three spurs on each side instead of with two on one side and one on the other; hind tibiae barely perceptably bowed in the apical half, the dorsal spurs no longer than the tibial depth, the apical pair separated from the preceeding by a distance equal to about the length of one of them; between each of the apical four pairs of dorsal spurs there are from three to four acutely conical teeth, between the two basal pairs there being two or three more; apical calcars moderate, the ventral outer one no more than one-half as great in general bulk than the median one; dorsal calcar a little longer than the median one, slightly longer than the apical dorsal spur, the inner one the longer, the outer one a little longer than the tibial depth, by actual measurement being about one-fourth longer; beneath the hind tibiae are armed with three very small spurs situated in the apical third on the median line.

Length, pronotum, 4.5 mm.; fore femora, 4.5 mm.; hind femora, 12 mm.

Female.—Known only from the nymph and showing no essential differences from the male. The very short ovipositor of this specimen, which is apparently in the last instar, indicates a corresponding shortness in the adult.

Holotype.—Male, Mount Hood, Oregon, Cloud Cap Inn, altitude 5,837 feet, August 19, 1910, Morgan Hebard collector; allotype, female, immature,. Hood River, Oregon, June, 1890, Washburn collector.

Holotype in Hebard collection; allotype in collection of the United States National Museum, Cat. No. 19463.

In the large number of serrations between the dorsal spurs of the hind tibiae this species approaches quite closely the species of the genus *Ceuthophilus*, more so than any other species of *Phrixocnemis* known to me.

Regarding the type-specimen of the present species, Mr. Hebard, the collector, writes as follows:

> Under bark of log among scattered conifers near timber line, elevation 6,300 feet.

PHRIXOCNEMIS NEOMEXICANUS Scudder.

This species, as stated under *Ceuthophilus*, the genus under which it was described, is a true *Phrixocnemis*. Besides the holotype, the United States National Museum possesses two immature females, apparently almost full grown, one bearing the same data as the holotype and the other from Durango, Colorado, June 26, 1899, E. J. Oslar collector; a female, also immature, from Albuquerque, New Mexico, and one male from Williams, Arizona, May 27, Barber and Schwarz collectors. These female specimens show the armature and structure of the posterior limbs to be the same as in the male, except the ventral serrations of the femora are probably somewhat smaller; between the dorsal spurs of the hind tibiae of both sexes there are usually no serration, but sometimes there is one or two, and the second segment of the corresponding tarsi is shorter than deep

Figure 23 shows the posterior tibia and tarsus of the holotype.

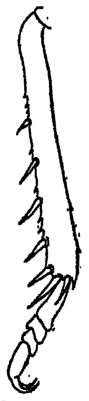

FIG. 23.—PHRIXOCNEMIS NEOMEXICANUS. HIND TIBIA AND TARSUS OF MALE TYPE, INNER SIDE.

PHRIXOCNEMIS SOCORRENSIS Rehn.

PHRIXOCNEMIS FRANCISCANUS Rehn.

These two species are apparently true *Phrixocnemis*, but are unplaced in the key, as the types are not available for study at this time. Specimens in the collections in Philadelphia show little structural differences from *P. vierecki*, but are smaller.

PHRIXOCNEMIS SERRATA Rehn.

The remarks on the above species also apply here. This species was described in the genus *Udeopsylla*, but the absence of a dorsal spine on the anterior femora excludes it from that genus. Its true generic position is clear from material determined by Rehn in the collection of the Philadelphia Academy of Sciences.

PHRIXOCNEMIS, species.

In the Hebard collection is a single male specimen of a dark-brown color and with a reddish stripe above, which runs out in the key of species to *P. neomexicanus*, but is too large, and the color is not as in the known specimens of that species. The pronotum of this specimen is 5 mm. long and the hind femora measures 11 mm. in length. The locality is West Point, Nebraska, and the date May 20. It probably represents a new species, but until more material is available for study it is thought best to not describe it as such.

RHACHOCNEMIS, new genus.

This genus is allied to *Phrixocnemis* Scudder, but the long, close-set dorsal spurs of the posterior tibiae impart a very different general appearance. These spines are long and heavy, those toward the tip on the inner margin being twice as long as the tibial depths at the point of attachment and separated by a distance no greater than the width of one of them (fig. 24). The upper apical calcar is situated dorsally and directed upward, thus differing scarcely at all from the dorsal spurs. The tarsi are typically all four segmented, but in

R. hostiferus Rehn the anterior tarsi have but three segments. The general structure of the head and body is as in *Ceuthophilus*. The subgenital plate of the male is apically deeply divided, the angles elongate, of the female apically entire; cerci of both sexes cylindrical and tapering gradually to a point.

Besides *R. validus* Scudder, type of the genus, there is to be referred to this genus the allied *Phrixocnemis bellicosus* of Scudder and the somewhat aberrent *Phrixocnemis hostiferus* of Rehn. This last species is distinguished most remarkably by having the anterior tarsi with but three segments, as mentioned above in the generic diagnosis. The only other members of this subfamily with three segmented anterior tarsi, so far as known to me, are the two species of *Daihinia*, where, however, the hind tarsi are also three-jointed. Another character in which *hostiferus* differs from the more typical members of this genus is the structure of the posterior tarsal segments, which are prolonged posteriorly beneath as very long acute angles (fig. 24).

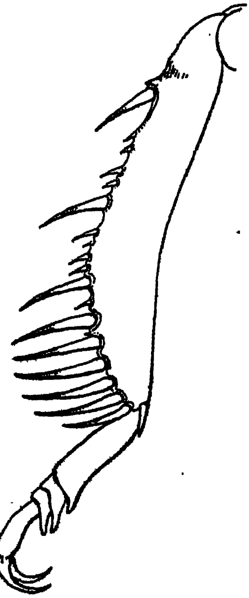

FIG. 24.—RHACHOCNEMIS HOSTIFERUS. HIND TIBIA AND TARSUS OF FEMALE TYPE, INNER SIDE.

A male specimen in the United States National Museum from Colorado Springs, Colorado, which I have referred to *R. hostiferus* with some doubt, is somewhat larger than the female holotype, and the posterior femora are armed beneath at the apical third on the outer carina with a single very long heavy spine with a few black-tipped serrations following it, the inner carina armed on the apical three-fourths with several similar serrations. This armature is very different from that of either of the other two known species of the genus.

The allotype of Scudder's *Phrixocnemis truculentus*, a single female from Colorado, is not conspecific nor congeneric with the male holotype from Nebraska, but is a *Rhachocnemis* and a synonym of *R. hostiferus* Rehn, with which it agrees, except that one of the spines of the outer ventral carina of the hind femora is decidedly larger than the others, while in the holotype of *hostiferus*, which is in the United States National Museum, there is no such inequality. The fact that the anterior tarsi of *hostiferus* are three jointed evidently escaped the notice of both Scudder and Rehn, as neither make mention of this peculiarity.

Type of the genus.—*Rhachocnemis validus* Scudder.

Genus DAIHINIA Haldeman.

Daihinia HALDEMAN, Proc. Amer. Assoc. Adv. Sci., vol. 2, 1850, p. 346.

This genus is remarkable in the structure of the fore and hind tarsi, where there are only three segments developed instead of four, as in all other known genera of the subfamily. The fastigium of the vertex is not tuberculate and the antennae are not very long; the palpi are short, the third and fifth segments of about equal length, the fifth sulcate ventrally in the apical half, fourth segment a little shorter than the third or fifth, the first and second not or barely more than half as long as the third, the first the shorter. Pronotum truncate before and behind; lateral lobes subquadrate or slightly longer than high, the lower margins horizontal and broadly rounded; meso and metanotum together approximately as long as the pronotum, the lateral lobes descending about as far as those of the pronotum, their lower margins rounded. The posterior femora are armed beneath in the type-species, *brevipes*, and unarmed in *phrixocnemoides* Caudell; hind tibiae armed above on both margins with about half a dozen very large spines, those on the inner margin somewhat longer, a few small serrations between some of the longer spines, especially on the basal half of the tibia. Ovipositor moderately stout and somewhat longer than the pronotum, the inner valves in the adult armed beneath with four long subapical teeth and terminated by an apical hook; subgenital plate of the male deeply fissured apically.

There are two species referred to this genus and they may be separated as follows:

KEY TO THE SPECIES OF DAIHINIA.

Posterior femora of both sexes armed beneath; hind tibiae with the large dorsal spurs naked and the apical four on the inner margin mostly separated by spaces fully as great as their own width (fig. 25); claws of hind tarsi scarcely more than one-half as long as the segment from which they arise .... *brevipes* Haldeman

Posterior femora of female, and probably also of the male, unarmed beneath; large dorsal spurs of the hind tibiae distinctly pilose and the apical four or five mostly separated by distances scarcely as great as their own width; claws of hind tarsi almost as long as the segment from which they arise.................... *phrixocnemoides* Caudell.

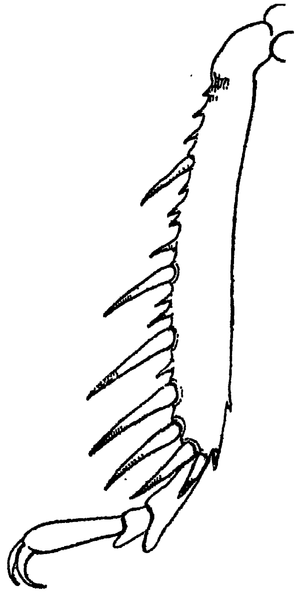

FIG. 25.—DAIHINIA BREVIPES. HIND TIBIA AND TARSUS OF FEMALE, INNER SIDE.

DAIHINIA BREVIPES Haldeman.

This species, the type of the genus, is a large robust brown insect occurring from Louisiana, the type-locality, north to Wyoming and North Dakota. In size it varies moderately, adults before me measuring as follows:

Length, males and females, pronotum, 6–7 mm.; hind femora, 12–15 mm.; ovipositor, 10–11 mm.

The males have remarkably heavy posterior femora, which are as broad as or broader than the pronotal length, tapering but very moderately at either end and armed beneath on the apical half of the outer carina with three or four heavy spines, the inner carina with several small tubercles.

DAIHINIA PHRIXOCNEMOIDES Caudell.

This species, which was described from a single female specimen from New Mexico, has been sent in to the United States National Museum from Pony, Texas, by Mr. Pryor Mapes, with the statement that they occur in that locality in injurious numbers, the damage done being the cutting off of plants at night. Specimens of both sexes were received in February and April, 1914, but unfortunately all were immature. The males, so far as shown by this material, do not differ materially from the females. Figure 26 shows the holotype.

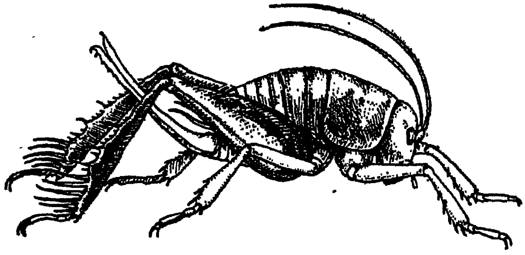

FIG. 26.—DAIHINIA PHRIXOCNEMOIDES. FEMALE TYPE.

Genus UDEOPSYLLA Scudder.

Udeopsylla SCUDDER, Can. Nat. and Geol., vol. 7, 1862, p. 284.
Marsa WALKER, Cat. Derm. Salt. Brit. Mus., vol. 2, 1869, p. 253.

The presence of a dorsal spine about or just beyond the middle of the anterior tibiae on the inner side will serve to readily separate this genus from allied forms in which the second segment of the hind tarsi is no longer than deep. Rarely one or both anterior tibiae will have two dorsal spines instead of a single one, and I have seen one specimen, a female in the Hebard collection, with two on one tibiae and three on the other.

A study of the unique male type of *Marsa arcuata* Walker in the British Museum, made by the writer in 1913, showed without doubt that it is a synonym of the type species of the genus *Udeopsylla*, the *Phalangopsis* (*Daihinia*) *robusta* of Haldeman. Thus the genus *Marsa* Walker falls into the synonymy under *Udeopsylla* Scudder.

The posterior femora of the male *Udeopsylla* have the same heavy broad shape as described under *Daihinia*, but lack the heavy spines on the lower outer carina as present in that genus, here this carina being armed only with a number of sharp triangular serrations, the inner margin with longer ones, forming short stout spines.

There appears to be but a single species referable to *Udeopsylla*. This is the *U. robusta* of Haldeman, the type of the genus. It is a large, robust insect exhibiting unusual variation in both size and color.

A large black male specimen in the Scudder collection has the pronotum 9 mm. long and the posterior femora 23 mm. Black and brown ones almost as large are in the collection of the United States National Museum, while other apparently fully grown males are much smaller. The posterior femora vary considerably in comparative length, ranging from two and one-half to three times the length of the pronotum, but this variation is correlated with neither habitat nor color. The insects vary in color from the uniform black, through various shades of dark brown to a nearly uniform yellowish brown. There seems to be a complete gradation in this variation of both size and color. The extremes occupy common ground and are evidently of no racial distinctness, though certain forms may be designated as color varieties. The color varieties thus recognizable may be separated by the following key:

KEY TO THE COLOR VARIETIES OF UDEOPSYLLA ROBUSTA.

1. General color black, top of thorax and legs sometimes lighter......*nigra* Scudder.
General color ranging from dark brown to medium or light reddish or yellowish brown..2.
2. General color ranging from dark brown to medium reddish brown, sometimes noticeably marked with blackish..........................*robusta* Haldeman.
General color an almost uniform light yellowish brown............*devius* Scudder.

UDEOPSYLLA ROBUSTA Haldeman.

Udeopsylla robusta Haldeman, Proc. Amer. Assn. Adv. Sci., vol. 2, 1850, p. 346.
Marsa arcuata Walker, Cat. Derm. Salt. Brit. Mus., vol. 2, 1869, p. 254.
Udeopsylla compacta Bruner, Can. Ent., vol. 23, 1891, p. 38.
Ceuthophilus politus Scudder, Proc. Davenp. Acad. Sci., vol. 9, 1902, p. 56.

This, the most common form, and the typical variety, occurs in various shades of brown and reddish brown connecting the black *nigra* with the yellowish-brown *devius*. In the synonymy under this form is to be placed the *Ceuthophilus politus* of Scudder,[1] the type of which has been studied and found structurally the same as *robusta* and agreeing in color. Scudder states that the anterior femora of *politus* are unarmed beneath on the inner margin, but it really has a distinct preapical spine.

Udeopsylla compacta Bruner is correctly listed in the synonymy under *robusta*.

As stated under the discussion of the genus, the type of *Marsa arcuata* Walker was examined and found to be a *Udeopsylla* referable to the synonymy under the present variety. The unique male type measures as follows: Pronotum, 7 mm.; fore femora, 8.5 mm.; hind femora, 14 mm. The color of this specimen is lighter than usual, varying toward the unicolorously light-yellowish variety *devius*. The pronotum is margined anteriorly and posteriorly with darker color, as are also the meso- and metathorax posteriorly.

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[1] Proc. Davenport Acad. Sci., vol. 9, 1902, p. 56.

UDEOPSYLLA NIGRA Scudder.

Udeopsylla nigra Scudder, Can. Nat. and Geol., vol. 7, 1862, p. 284.
Ceuthophilus niger Scudder, Bost. Journ. Nat. Hist., vol. 3, 1862, p. 437.
Daihinia gigantea Bruner, Bull. Washb. Coll., vol. 1, 1885, p. 127.
Ceuthophilus ater Scudder, Proc. Davenp. Acad. Sci., vol. 9, 1902, p. 57.

This form is distinguished by the general black color. The blackish color of *Udeopsylla gigantea* Bruner, originally described in the genus *Daihinia*, indicates that it should be placed here and *Ceuthophilus ater* Scudder, as determined from a study of type material, is but a nymph of this insect. *Ater* is nothing but a still younger and darker specimen than *Ceuthophilus politus*, placed above in the synonymy under the typical form *robusta*.

Ceuthophilus niger Scudder is a synonym of *Udeopsylla nigra* and was described in November, six months later than *U. nigra*.

UDEOPSYLLA DEVIUS Scudder.

Ceuthophilus devius Scudder, Proc. Amer. Acad. Arts Sci., vol. 30, 1894, pp. 30, 99.

The type of this species has been examined and found to be a true *Udeopaylla* and separable from the typical form only by the almost uniform light yellowish brown color. It is therefore here transferred to this genus and designated a color variety of *robusta*.

Genus HEMIUDEOPSYLLA Saussure and Pictet.

Hemiudeopsylla Saussure and Pictet, Biol. Cent. Amer., Orth., vol. 1, 1897, p. 300.

This genus seems very closely allied to, if not identical with, *Ceuthophilus*. The type-specimen of the genotypic species, *H. genicularis* Saussure and Pictet, a single male with the posterior tibiae missing, was seen in 1913 at a time when more than a casual glance was impossible, and a note written at that time states that it looks like a *Ceuthophilus* with the hind femora finely serrated beneath. This same note states that the type material of *H. forreriana* Saussure and Pictet, consists of a small female and a minute legless male, probably also a *Ceuthophilus*.

Two species of this genus have been recorded from the region covered by the present paper, *H. platyceps* Saussure and Pictet and a species named and recorded by Saussure and Pictet as *Hemiudeopsylla californiana* Scudder, under the impression that it was the insect described under that specific name by Scudder in the genus *Ceuthophilus*. But, as pointed out by Scudder,[1] their description does not at all fit this species. From the structure of the vertex as described by Saussure and Pictet it seems probable that the specimen described by them is a species of *Pristoceuthophilus*. A photograph of this specimen was kindly sent the writer some years ago by the director of the Musée d'Histoire Naturelle of Geneva and an outline drawing made from this photograph is here reproduced (fig. 27).

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[1] Canadian Entomologist, vol. 31, 1899, p. 121.

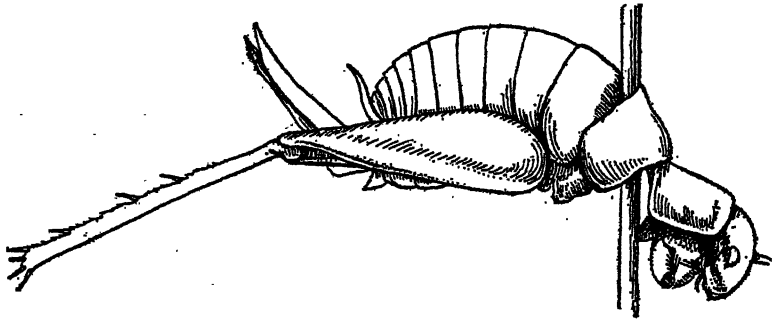

FIG. 27.—HEMIUDEOPSYLLA CALIFORNIANA. ADULT FEMALE TYPE, FROM PHOTOGRAPH.

This photograph, considerably enlarged though it is, fails to show sufficient details to enable the correct placing of the species. If, upon examination of the specimen, this insect proves distinct from any described form, a new name will be necessary for it.

Together with the above-mentioned photograph was received one of the second United States species, *H. platyceps* Saussure and Pictet. An outline drawing of the hind tabia and tarsus made from this photograph is also here reproduced (fig. 28).

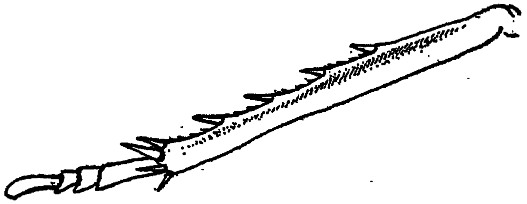

FIG. 28.—HEMIUDEOPSYLLA PLATYCEPS. HIND TIBIA AND TARSUS OF MALE TYPE, FROM PHOTOGRAPH.

CNEMOTETTIX, new genus.

The material upon which this genus is based was found in a neglected lot of alcoholic specimens after the page proof of this article was received and only a brief discussion of its characters can therefore be inserted. The vertex is entire and the legs short, the hind femora scarcely as long as the body, but the most important characters lie in the tibiae and tarsi. The tarsi have more or less well-developed pulvilli beneath, double on the metatarsus, the fore tibiae are without hearing organs, and the hind tibiae are armed above with a series of stout elongate-triangular inarticulate spurs of which about every alternate one is approximately twice as large as the others, the longest scarcely more than half as long as the tibial depth; fore tibiæ unarmed above except apically. Ovipositor twice as long as the pronotum, decidedly curved upward and entirely unarmed.

This genus is structurally allied to *Gammarotettix* and the presence of pulvilli in both genera indicates that they might better be referred to the subfamily Stenopelmatinæ. The new genus is readily distinguishable from *Gammarotettix* by the undivided vertex and the possession of much longer apical calcars of the hind tibiae. *Diestrammena* and *Tropidischia* share with the present genus and *Gammarotettix* the character of inarticulate dorsal spurs on the hind tibiae, but those long-legged insects have no indication of pulvilli.

Type of the genus.—*Cnemotettix pulvillifer*, new species.

CNEMOTETTIX PULVILLIFER, new species.

In general appearance this species resembles those of the genus *Phrixocnemis*. The general color is yellowish brown mottled with darker brown. The head is marked on each side above and below the eyes with a narrow black streak and the frontal costa between the antennae is infuscated.

Length, pronotum, male, 3.5 mm., female, 4 mm.; hind femora, male, 10 mm., female, 12 mm.; ovipostor, 9 mm.

Described from one adult and two immature males and one adult female from San Clemente Island, California, T. L. Casey, collector. Holotype here selected, adult male. Catalogue No. 19965 U. S. Nat. Museum.

INDEX.

Page.

- Acartia tonsa 540
- Acemyiopsis 433
  - punensis 433
- Acrididae, notes on some United States grasshoppers of the family 25
- Acris gryllus 354
- Adelura ampla 82
  - dimidiata 86
  - montana 86
  - montanus 86
  - tibialis 85
- Ademon niger 67
- Admontia retiniae 625
  - setigera 626
- Aeoloplides 28
- Aeshna californica 270, 343
  - interrupta interna 327, 336
  - multicolor 266, 270, 313, 338, 344
  - palmata 266, 271, 329, 344
  - umbrosa occidentalis 266, 271, 315, 328, 330, 331, 344
- Agicuphocera 430
  - nigra 430
- Agosia chrysogaster 584
- Agrion aequabile 270, 334
  - yakima 266, 315, 338
  - maculatum 339
- Agromyza, flies of the genus, related to Agromyza virens 103
- Agromyza coniceps 107
  - eupatoriae 107
  - gibsoni 106
  - parvicornis 152
  - riparia 105
  - subvirens 105
  - virens 104, 106
- Ailurus 144
  - fulgens 144
- Akicera frauenfeldi 479
  - heeri 479
- Alaba oldroydi 49
- Aldrich, John Merton, The dipterous genus Symphoromyia in North America 113
- Alexander, Charles Paul, On a collection of Javanese crane-flies (Tipulidae, diptera) in the United States National Museum 157
- Allobracon 94
- Allogramma amabilis 455
- Allophanite, fuchsite, and triphylite, notes on 463
- Allosaurus fragilis, on the fore limb of 501
  - fratilis 501, 503
- Alonella karua 540
- Alophora pulverea 633

Page.

- Alpha 28
- Alydus conspersus 477
- Alytes obstetricans 379
- Ambystoma jeffersonianum 352
  - maculatum 354
  - tigrinum 354
- Amersibia 224
  - prionoxysti 224
- Ammobia spiniger 244
- Amphiagrion saucium 270, 289, 326, 329, 331, 332, 336, 341
- Amphibians and reptiles from Gogebic County, Michigan 351
- Anastrepha striata 77
- Anatina cuneata 454
  - striata 453
- Anatinacea, a review of some bivalve shells of the group, from the west coast of America 441
- Anax junius 289, 333, 336, 343
- Anculosa arkanensis 587
  - subglobosa 587
  - virgata 587
- Ancylocheira liasina 480
- Anemorilla 432
  - rufescens 432
- Aneurhynchus conservatus 482
- Anhydrophilus brodiei 478
- Anodontites from Brazil, three new species of 527
  - aurora 529
  - darochai 528
  - salmonea 527
  - sinuosus 528, 529
  - trapezialis 529
- Antocha indica 171
  - javanensis 171
- Apanteles (Apanteles) sibinidis 227
  - (Protapanteles) probetri 228
- Archilestes californica 260, 271, 339
  - grandis 259, 268
- Argia emma 266, 271, 338, 340
  - vivida 266, 288, 289, 292, 332, 341
- Argyreomyia 426
  - busckii 426
- Asthenothaerus villosior 446
- Atarba diffusa 172
  - flava 172
  - javanica 171, 172
  - lamellaris 172
  - nebulosa 172
  - picticornis 492
  - pilifera 172
  - vectensis 492
- Atelecephala 617
- Atherix melaena 113

Page.

- Atya scabra 532, 551
- Banta, Arthur M., and Ross Aiken Gortner, An albino salamander, Spelerpes bilineatus. 377
- Bartsch, Paul, The Philippine land shells of the genus Schistoloma 195
  - The recent and fossil mollusks of the genus Rissoina from the west coast of America 33
- Bassaricyon 149
  - gabbii 149
- Bassus coleophorae 230
- Batazonus 237
  - hookeri 237
  - mundiformis 238
- Belote, Theodore T., Descriptive catalogue of the Washington relics in the United States National Museum 1
- Belvosiomima 413
  - fosteri 414
- Bentheuphausia amblyops 636
- Bethlehem, Pennsylvania, a peculiar oolite from 153
- Bibiodites 493
  - confluens 493
- Bigelow, Henry B., Eperetmus, a new genus of Trachomedusae 399
- Biosteres indotatus 74
- Blennocampa assamensis 209
  - gracilicornis 209
- Bolomyia 436
  - violacea 436
- Bombinator pachypus 379
- Boopedon flavofasciatum 29
  - fuscum 30
  - nubilum 29
    - var. maculata 29
- Bracon diastatae 88
  - gracillariae 90
- Brazil, three new species of Anodontites from. 527
- Buccinum compositum 563
  - crispatum 563
  - lamellosum 563
  - plicatum 563
- Bufo americanus 353, 354
  - viridis 379
- Bushia panamensis 446
- Butorides virescens 255, 515
- Callinectes ornatus 553
- Caloblattina liasina 475
- Caloptenus regalis 28
- Calpodomyia 414
  - linearis 415
- Camposcopus aclerivora 226
- Campsomeris (Campsomeris) pyrura 235
- Camptosaurus depressus 605
- Candelabra, lamps, and candlesticks belonging to Washington 6
- Candlesticks, candelabra, and lamps belonging to Washington 6
- Cardisoma guanhumi 553, 554
- Casanowicz, I. M., A colored drawing of the Medeba mosaic map of Palestine in the United States National Museum 359
- Catostomus generosus 577
  - gila 574

Page.

- Catostomus insignis 574
  - latipinnis 581
  - plebius 578
  - sonorensis 575
- Caudell, A. N., Notes on some United States grasshoppers of the family Acrididae 25
  - The genera of the tettiginiid insects of the subfamily Rhaphidophorinae found in America north of Mexico 655
- Celatoria spinosa 633
- Ceratosaurus nasicornis 501, 507
- Cerceris festiva 248
  - margaretella 248
- Ceropales fraterna, var. occidentalis 236
  - neomexicana 236
  - stretchii 236
- Ceuthophilus 664
  - alpinus 666
  - ater 666
  - californianus 679
  - celatus 666, 671
  - devius 666, 688
  - genitalis 666, 668
  - gracilipes 666
  - grandis 666
  - henshawi 664, 671
  - neomexicanus 665
  - nodulosus 667, 669
  - palmeri 667
  - politus 666, 687
  - seclusus 667
  - stygius 666
  - terrestris 667
  - uhleri 667
  - vinculatus 665
- Chaetogaediopsis 620
- Chaetophleps crassinervis 624
  - polita 625
  - rostrata 624
- Chaetophlepsis 422
  - tarsalis 423
- Chaetostigmoptera 624
- Chelydra serpentina 354
- Chinaware belonging to Washington 9
- Chorophilus nigritum 354
- Chrysemys bellii 353, 354
- Chrysoexorista 435
  - viridis 435
- Cimbex carinatula 215
- Cimbicisoma 215
  - dendrobii 215
- Clausicella johnsoni 623
  - setigera 623
  - tarsalis 623
- Clytiomyia atrata 633
- Cnemotettix 689
  - pulvillifer 690
- Cockerell, T. D. A., British fossil insects.... 469
- Coelodon ceylanica 451
  - radians 450
- Coenagrion resolutum 335
- Coenobita diogenes 534, 539, 551
- Colombia, Santa Marta, crustacea collected in, by the Walker Expedition 531

Page.

- Colorado, Entomostraca from, with descriptions of two new species 97
- Coniana snowi 26
- Conosia irrorata 174
- Coptocheilus altum 195, 197
  - var. protracta 197
  - mcgregori 200
  - quadrasi 203
    - rhodochilus 203
- Cordillacris 28
- Cordulia shurtleffi 336, 344
- Crane-flies, Javanese, a collection of, in the United States National Museum 157
- Croesus castaneae 213
- Crustacea collected in Colombia by the Walker Expedition 531
- Crustacean, a new, Diaptomus virginiensis, and a description of Diaptomus tyrelli 457
- Crustaceans of the order Eupahusiacea gathered by the Albatross Expedition to the Philippines 635
- Ctenacroscelis monochrous 182
  - praepotens 182
  - sumatranus 182
  - umbrinus 182, 185
- Ctenophora ardens 179
- Cubaia geophila 401
- Cubaris brevispinis 534, 543
  - cincta 543
  - gigas 544
- Culex petrifacellus 489
  - protolepis 488
  - protorhinus 488
- Cyathodonta cruziana 445
  - dubiosa 445
  - galapagana 445
  - granulosa 444
  - lucasana 445
  - magnifica 444
  - pedroana 445
  - plicata 444
  - undulata 444, 445
- Cyclops leuckarti 539
  - var. edax 540
- Cyclostoma altum 197
- Cylindrotoma quadricellula 178
- Cyprinodon macularius 586
- Dalhinia 685
  - brevipes 685
  - phrixocnemoides 686
- Dall, William Healey, A review of some bivalve shells of the group Anatinacea from the west coast of America 441
  - Notes on the species of the molluscan subgenus Nucella inhabiting the northwest coast of America and adjacent regions 557
- Degeeria washingtonae 626
- Demoticus piperi 629
- Desmatophoca oregonensis 383
- Desmiostoma kukaense 74
- Desmostylidae 385

Page.

- Desmostylus hesperus, a contribution to the knowledge of the extinct Sirenian 381
  - hesperus 383, 384, 390, 396
  - watasei 396
- Diachasma appalachicolus 72
  - crawfordi 73
  - secunda 72
- Diaptomus arapahoensis 99
  - birgei 459
  - coloradensis 461
  - leptopus, var. piscinae 102
  - marshi 539, 540
  - pribilofensis 459, 462
  - shoshone 101, 102
  - tyrelli 459, 462
  - virginiensis 457
- Dicranomyia albitarsis 159
  - atrescens 160
  - carneotincta 162
  - cuneiformis 159
  - erythrina 161
  - excelsa 161
  - saltens 159
  - simplissima 162
  - tenella 162, 163
  - whartoni 162
- Diemictylus viridescens 354
- Diestrammena 659
  - unicolor 661
- Dimorphopteryx coloradensis 206
- Dinosaur, an orthopodous, from the Lance formation of Wyoming, Thescelosaurus, osteology of 591
- Dionæa nitoris 631
- Dodds, G. S., Descriptions of two new species of Entomostraca from Colorado, with notes on other species 97
- Dolichamobia 408
  - auromaculata 408
- Dolichoderus anglicus 484
  - britannicus 483
  - obliteratus 484
  - ovigerus 484
- Dolichopeza gracilis 179
- Dolichothynnus silvicola 233
- Dragonflies of Washington and Oregon, notes on the life history and ecology of the 259
- Drepanoglossa occidentalis 628
- Echinomasicera 413
  - hystrix 413
- Echinomyia flaviventris 630
- Ectophasiopsis 439
  - chilensis 440
- Elaterophanes acutus 478
  - socius 478
- Elcana britannica 473
  - liasina 472
- Elis xanthonotus 234
- Emphytina vanduzeei 205
- Enallagma anna 325, 329
  - calveri 325, 332, 341
  - carunculatum 270, 331, 338, 341
  - clausum 341
  - cyathigerum 270, 289, 331, 332, 335, 341
  - ebrium 331

Page.
Engravings, paintings, and statues belonging to Washington 3
Entodesma (Agriodesma) saxicola 456
  scammoni 456
  chilense 454, 455
  inflatum 455
  pictum 455
  scammoni 456
  spongiophila 455
Entomostraca from Colorado, descriptions of two new species 97
Eospilipteron 472
  ornatum 472
Eperetmus, a new genus of Trachomedusae 399
  typus 401
Epiphanocera 419
  costalis 419
Epiphragma signata 174
Ephydra gracilis 495
  hians 495
  millbrae 495
  oligocena 495
  sepulta 495
Eriocera acrostacta 177
  basilaris 177
  cingulata 178
  mesopyrrha 177
  verticalis 177
Erioptera (Acyphona) fenestrata 172
  (Erioptera) javanensis 172
  javanensis 172
Erythemis simplicollis 270, 287, 333, 344
Euamphibolia 618
Euchaetophleps 625
Euepalpodes 429
  arcuatus 429
Eugaedia 621
Eugaediopsis 620
Eulasiona spinosa 626
Euphausia brevis 636
  diomedeae 636, 639
  fallax 645, 646
  gibboides 646
  hemigibba 636, 644
  mutica 642
  paragibba 636
  pseudogibba 636, 643
  recurva 636, 642
  sibogae 636, 645
  similis 636, 642
  tenera 643
Euphausiacea, crustaceans gathered by the Albatross Expedition to the Philippines of the order 635
Euphorocera gelida 622
Euponera succinea 483
Euprocyon 146
Euryalona occidentalis 540
Euthryptocera 624
Eutrichopsis agromyzae 86
  oscinidis 90
Euura cosensii 213
Evans, Arthur T., A collection of amphibians and reptiles from Gogebic County, Michigan 351
Exenterus diprioni 222

Page.
Exoristopsis 426
  setifera 427
Fishes, notes on a collection of, made by Dr. Edgar A. Mearns from rivers tributary to the Gulf of California 573
Flies, muscoid, new genera of 617
  new Neotropical muscoid 405
  of the genus Agromyza, related to Agromyza virens 103
  of the genus Pseudodinia, with description of a new species 151
Foveadens panamensis 451
Fuchsite, allophanite, and triphylite, notes on 463
Furniture belonging to Washington 5
Gaediopsis cockerellii 620
  ocellaris 620
  setosa 621
Gahan, A. B., A revision of the North American Ichneumon-flies of the subfamily Opiinae 63
Gammarotettix 661
  bilobatus 664
  genitalis 663
Gecarcinus lateralis 554
Geranomyia decemguttata 164
  javanica 164
  linearis 163
  nitida 163
  pulchripennis 164
Gila elegans 580, 581
  gibbosa 581, 582
  nigra 582
  robusta 581
  seminuda 581
Gilmore, Charles W., A new restoration of Stegosaurus 355
  On the fore limb of Allosaurus fragilis 501
  Osteology of Thescelosaurus, an orthopodous dinosaur from the Lance formation of Wyoming 591
Glaphyroptula anglica 480, 481
  liasina 480
Glassware belonging to Washington 13
Gnamptodon atricaudus 92
  nepticulae 68
Gnesia calirose 220
Gnophomyia ornatipennis 167
Gomphus, sp 342
Goniobasis plebius 587
Goniodineura nigriceps 165
Gonionemus murbachii 401, 403
  suvaensis 401
  vertens 401, 402
Gonomyia affinis 173
  (Gonomyia) bryanti 173
Gorgosaurus libratus 513
Gortner, Ross Aiken, and Arthur M. Banta., An albino salamander, Spelerpes bilineatus 377
Gossea brachymera 401
Gramptodon nepticulae 220
Grapsus grapsus 553
Grasshoppers of the family Acrididae, notes on 25

Page.
- Great Britain, fossil insects from … 469
- Hadenoecus puteanus … 659
  - subterraneous … 659
- Haglopsis brodiei … 474
  - parallela … 474
- Hansen, H. J., The Euphausiacean Crustaceans of the Albatross Expedition to the Philippines … 635
- Hay, Oliver P., A contribution to the knowledge of the extinct Sirenian Desmostylus hesperus Marsh … 381
- Hedylus politus … 74
- Heliastus minimus … 25
- Heliaula … 27
- Hemidactylium scutatum … 354
- Hemiudeopsylla … 688
  - californiana … 688
  - forreriana … 688
  - genicularis … 688
  - platyceps … 688, 689
- Hinea … 629
- Hinkley, Anson A., New fresh-water shells from the Ozark Mountains … 587
- Hippelates brodiei … 496
- Holcoptera confluens … 480
  - giebeli … 480
  - schlotheimi … 480
- Hollister, N., The genera and subgenera of raccoons and their allies … 143
- Homalomma … 218
  - caliroae … 218
  - eriocampoides … 219
  - pteroideae … 219
- Hyla pickeringii … 352, 354
  - versicolor … 352, 354
- Hymenoptera, descriptions of new species of … 205
- Hypochaetopsis … 422
  - chaetosa … 422
- Hypostena flaveola … 621
- Hypsilophodon foxii … 615
- Ichneumon-flies of the subfamily Opiinae … 63
- Ichneutes bicarinatus … 94
- Iconomedina … 626
- Ictericophyto … 626
- Indarch, Russia, notes on the composition and structure of the meteoric stone from … 109
- Insects, British fossil … 469
- Insects, tettiginiid, of the subfamily Rhaphidophorinae found in America north of Mexico … 655
- Ischnura cervula … 266, 269, 270, 289, 295, 296, 329, 331, 332, 336, 341
  - perparva … 266, 269, 270 271, 289, 295, 310, 329, 331, 332, 336, 341
- Java, on a collection of crane-flies from … 157
- Kennedy, Clarence Hamilton, Notes on the life history and ecology of the dragonflies (Odonata) of Washington and Oregon … 259
- Kennerlyia bilirata … 449, 450
  - convexa … 449
- Lachnommopsis … 421
  - armata … 421
- Lagarotis diprioni … 217
  - virginianus … 218
- Lamps, candlesticks, and candelabra belonging to Washington … 6
- Larropsis dolosana … 245
- Larropsis gracilis … 244
- Lebia furcata … 480
- Leptothorax gurnetensis … 485
- Leptotrichus granulatus … 543
- Leskiopalpus … 629
  - calidus … 629
- Leskiopsis … 627
- Lestes congener … 266, 271, 324, 339
  - disjunctus … 324, 340
  - grandis … 259
  - uncatus … 324, 334, 340
  - unguiculatus … 324, 329, 340
- Leucorrhinia hudsonica … 337
  - intacta … 345
- Leucostoma atra … 631
  - neomexicana … 632
- Libellula forensis … 266, 289, 331, 333, 337, 338
  - pulchella … 270, 329, 330, 333, 344
  - quadrimaculata … 329, 331, 337, 344
- Libnotes familiaris … 165
  - montivagans … 165
  - nervosa … 165
  - nigricornis … 165
  - strigivena … 165
- Ligyda baudiniana … 550
  - richardsonae … 534, 549
- Limestones and marbles, report on some carbonic acid tests on the weathering of … 347
- Limnobia acrostacta … 177
  - annulifemur … 165
  - basilaris … 177
  - irrorata … 174
  - mesopyrrha … 177
  - saltens … 159
  - strigivena … 165
- Limnophila amica … 175
  - (Dicranophragma) remota … 176
  - opaca … 175
  - palmeri … 175
  - pallidicoxa … 176
  - simplex … 176
- Liopeltis vernalis … 354
- Locustopsis bucklandi … 473
  - dobbertinensis … 473
  - elegans … 473
  - lacoei … 473
- Lophosiocera … 623
  - curriei … 623
- Lygaeonematus robinsonae … 212
- Lyonsia (Allogramma) amabilis … 455
  - alvarezii … 454
  - arenosa … 453, 454
    - var. sibirica … 453
  - bracteata … 452
  - californica … 453
  - coruscans … 453
  - diaphana … 455
  - flabellata … 453
  - fretalis … 454
  - gibbosa … 453
  - gouldii … 453
  - var. haroldi … 453
  - inflata … 455
  - norvegica … 452
  - panamensis … 454
  - patagonica … 454
  - pugetensis … 454

Page.
Lyonsia saxicola ... 456
striata ... 452
ventricosa ... 453
Macneillia ... 28
Macrobrachium acanthurus ... 550
jamaicense ... 551
olfersii ... 550
Macromia magnifica ... 266, 313, 321, 344
Macrothrix laticornis ... 539, 540
Makasinocera ... 431
unguis ... 432
Malloch, J. R., Flies of the genus Agromyza, related to Agromyza virens. 103
Notes on the flies of the genus Pseudodinia, with description of a new species ... 151
Map of Palestine, a colored drawing of the Medeba mosaic, in the United States National Museum ... 359
Marbles and limestones, report on some carbonic acid tests on the weathering of ... 347
Marsa arcuata ... 686
tuberculata ... 672
Marsh, C. Dwight, A new crustacean, Diaptomus virginiensis, and a description of Diaptomus tyrelli Poppe ... 457
Marshall, William B. Three new species of Anodontites from Brazil ... 527
Mearns, Dr. Edgar A., Notes on a collection of fishes from the Gulf of California, made by. 573
Medeba mosaic map of Palestine, a colored drawing of, in the United States National Museum ... 359
Megalestes anglicus ... 498
Megalomastoma altum ... 197
quadrasi ... 203
Melanoplus coloradus ... 30
devastator ... 30
affinis ... 30
typicalis ... 30
diminutus ... 31
femur-rubrum ... 30
marginatus ... 30
pauper ... 30
minor ... 30
mutatus ... 30
virgatus ... 31
Merrill, George P., Notes on the composition and structure of the Indarch, Russia, meteoric stone ... 109
Report on some carbonic acid tests on the weathering of marbles and limestones ... 347
Meshemipteron ... 476
incertum ... 476
Metopia lateralis ... 619
leucocephala ... 619
Michigan, amphibians and reptiles from Gogebic County ... 351
Microbracon canadensis ... 93
coleophorae ... 231
dorsator ... 93
furtiosus ... 231
hemimenae ... 232
niger ... 93
rejectus ... 93
Microcalliphora ... 618
Micronychiops ... 423
aurescens ... 424
Microplagia ... 437
nitens ... 437
Microsenotainia ... 618
Microtes nubila ... 28
occidentalis ... 28
Miltogramma decisa ... 619
nana ... 619
Minca ... 544
ruthveni ... 534, 546
Minomus jarrovii ... 577
platyrhynchus ... 577
Minthopsis ... 417
vittata ... 417
Moerophora neoclyti ... 223
Moina brachiata ... 540
Moinodaphnia macleayii ... 540
Mollusks of the genus Rissoina from the west coast of America ... 33
Mongoma cariniceps ... 173
saucia ... 174
Murdockiana ... 622
Murex crispatus ... 563
ferrugineus ... 563
lactuca ... 563
Musca leucocephala ... 619
Muscoid flies, diagnoses of new genera of ... 617
new neotropical ... 405
Mya norvegica ... 452
striata ... 452
Mycetophila vectensis ... 490
Myiobia thecata ... 627
Myobiopsis ... 628
similis ... 628
Mytilimeria nuttallii ... 456
Nasonimyia ... 619
Nasua ... 147
olivacea meridensis ... 148
Nasuella ... 148
Necropsylla anglica ... 483
Necturus maculosus ... 354
Nematobrachion boopis ... 651
flexipes ... 636, 651
Nematophlebia ... 475
plicata ... 476
Nematoscelis atlantica ... 649
gracilis ... 650
lobata ... 648, 649
microps ... 648, 649
tenella ... 650
Nemoraea labis ... 627
setigera ... 629
Neoarchytas ... 430
inambarica ... 431
Neodionaea ... 631
Neometachaeta ... 415
polita ... 416
Neominthopsis ... 418
discalis ... 418
Neopsalida ... 632
Nephopteropsis ... 623
Nesopeza gracilis ... 179
Notolepidomyzon clarki ... 574, 575, 577, 578
generosus ... 578, 579
plebius ... 578
santa-anae ... 574, 578

Page.
Notropis mearnsi 574, 582, 583
Nucella, notes on the species of the molluscan subgenus, inhabiting the northwest coast of America and adjacent regions 557
  canaliculata 558, 560, 561
  emarginata 559, 560, 561
  freycinetii 561
  lamellosa 558, 560, 561, 562
  lapillus 557, 562
  lima 561
Nysson (Bathystegus) basirufus 247
Oberholser, Harry C., a synopsis of the races of the crested tern, Thalasseus bergii (Lichtenstein) 515
  Critical notes on the subspecies of the spotted owl, Strix occidentalis (Xantus) 251
Octhiphila 151
Ocypode albicans 555
Ocyptera euchenor 631
  flavifrons 530
Ocypterodes 631
Ocypteropsis 630
Odontosoma 633
Odynerus margartellus 242
  (Stenodynerus) anacardivora 241
    blawus 240
    odontoschius 241
    var. dichrous 241
    precampanulatus 240
Oecophylla atavina 485
  megarche 486
  perdita 485
Oedematocera 621
Oedematopteryx 633
Oestrogastrodes 425
  similis 425
Oestrogastropsis 424
  mexicana 425
Olindias phosphorica 401
  singularis 401
Olindioides formosa 401
Oncophanes atricaudus 92
Oolite from Bethlehem, Pennsylvania 153
Oomeigenia 434
  chosica 435
Ophiogomphus morrisoni 336
  occidentis 270, 289, 333, 338, 341
  severus 266, 270, 338, 341
Opiinae, a revision of the North American Ichneumon-flies of the subfamily 63
Opius aberrans 86
  americanus 91
  amplus 82
  anastrephae 81
  annulicornis 78
  anthomyiae 74
  apicalis 85
  appalachicolus 72
  aridis 88
  ashmeadi 78
  atriceps 91
  basinger 82

Page.
Opius bicarinatus 94
  bruneipes 88
  brunneitarsis 77
  brunneiventris 81
  canadensis 93
  canaliculatus 80
  cincticornis 78
  cinctus 81
  coloradensis 83
  commodus 87
  crassiceps 78
  crawfordi 73, 77
  diastatae 88
  dimidiatus 86
  ehrhorni 87
  (Eutrichopsis) agromyzae 86
  ferrugineus 75
  flaviceps 76
  foersteri 83
  forticornis 92
  foveolatus 74
  fuscipennis 79
  gracillariae 90
  grenadensis 92
  indotatus 74
  insularis 87
  interstitialis 86
  irridipennis 92
  kukakense 74
  luteiceps 85
  mandibularis 81
  melanocephalus 88
  melleus 73
  mellipes 83, 92
  montanus 86
  nanus 90
  niger 93
  nigrocastaneus 83
  oscinidis 90
  pallipes 92
  politus 74
  provancheri 81
  rejectus 93
  ruficeps 81
  rufocinctus 84
  salvini 88
  sanguinea 74
  sanguineus 74
  secundus 72
  striativentris 89
  succineus 81
  suturalis 89
  tantillus 86
  tibialis 85
  unifasciatus 86
  utahensis 82
  (Utetes) anastrephae 81
  variabilis 93
  viereckl 76
Oregon and Washington, notes on the life history and ecology of the dragonflies of 259
Orimarga borneensis 170
  javana 170
Ornepetes silvicola 233
Ornitholestes hermani 507, 510
Orthopelma luteolator 226
Orthophlebia communis 475
  intermedia 475

Page.

- Orthophlebia lata.......... 475
  - similis.......... 475
- Osteodesma aeruginosa.......... 453
  - nitidum.......... 453
- Owl, spotted, Strix occidentalis, notes on the subspecies of the.......... 251
- Ozark Mountains, new fresh-water shells from the.......... 587
- Pachyprotasis brunettii.......... 208
- Pachyrrhina doleschalli.......... 190
  - fallax.......... 190
  - immaculata pangerangensis.......... 191
  - ochripleuris.......... 190
- Paintings, engravings, and statues belonging to Washington.......... 3
- Palestine, a colored drawing of the Medeba mosaic map of, in the United States National Museum.......... 359
- Paltostomopsis.......... 489
  - ciliatus.......... 490
- Pandora cistula.......... 451
- Pandorina arenosa.......... 453
- Pantosteus arizonae.......... 575, 576
  - bardus.......... 577
  - clarki.......... 575, 576
  - delphinus.......... 575, 577, 578
  - jordani.......... 578
  - lahontan.......... 578
  - platyrhynchus.......... 578
  - virescens.......... 577, 579
- Panzeria penitalis.......... 627
- Paracypris perelegans.......... 541
- Parademoticus.......... 629
- Paradionaea.......... 631
- Parametopia.......... 619
  - morrisoni.......... 619
- Paramyocera.......... 405
  - discalis.......... 406
- Parapsalida.......... 632
- Paratropeza ornatipennis.......... 167
- Parepalpodes.......... 428
  - rimacensis.......... 429
- Patellipurpura patula.......... 558
- Patelloa.......... 619
- Pearse, A. S., an account of the crustacea collected by the Walker Expedition to Santa Marta, Colombia.......... 531
- Pedeticum.......... 28
- Peleteriopsis.......... 630
  - tegulata.......... 630
- Peneus brasiliensis.......... 539, 551
- Periploma alta.......... 447
  - argentaria.......... 447
  - carpenteri.......... 448
  - discus.......... 448
  - excurva.......... 447
  - excurvata.......... 447
  - (Halistrepta) sulcata.......... 448
  - lenticularis.......... 447
  - obtusa.......... 447
  - papyracea.......... 447
  - planiuscula.......... 447
  - stearnsii.......... 448
- Pezoporus (Schenkia) tenthredinarum.......... 216
- Pezotettix chenopodii.......... 28
- Pezotettix minor.......... 30
- Phaedrotoma sanguinea.......... 74

Page.

- Phalangopsis (Daihinia) robusta.......... 686
- Phanerogramma.......... 479
  - heeri.......... 479
- Phanerotoma laspeyresia.......... 230
- Phanomeris mellipes.......... 92
- Philippine Islands, land shells of the genus Schistoloma from the.......... 195
- Philippines, the Euphausiacean crustaceans of the Albatross Expedition to the.......... 635
- Philoponites.......... 482
  - clarus.......... 482
- Philoscia culebrae.......... 534, 541
  - nitida.......... 532, 542
  - walkeri.......... 534
- Phorocera leucaniae.......... 619
  - sternalis.......... 621
- Phrixocnemis.......... 676
  - bellicosus.......... 684
  - hostiferus.......... 684
  - longispinosus.......... 677
  - neomexicanus.......... 682, 683
  - obesus.......... 679, 682
  - oregonensis.......... 681
  - serrata.......... 683
  - socorrensis.......... 683
  - species.......... 683
  - truculentus.......... 680, 684
  - vierecki.......... 680
- Phylacteropoda.......... 623
- Phyllophorocera.......... 621
- Phyto admontia.......... 626
  - nigricornis.......... 632
- Piagetia.......... 245
- Pison aureosericeum.......... 246
  - (Parapsion) erythrogastrum.......... 247
  - peletieri.......... 246
- Plagimasicera.......... 411
  - petiolata.......... 411
- Plagopterus argentissimus.......... 584
- Plathemis lydia.......... 266, 270, 344
- Plethodon erythronotus.......... 352, 354
- Poecilia occidentalis.......... 585
- Polyplex rugosus.......... 563
- Polyterus caliroae.......... 221
  - olympiae.......... 221
- Polytropa crispata.......... 563
  - lapillus.......... 571
- Ponera hypolitha.......... 483
- Pontania amentivora.......... 209
- Potos.......... 149
- Prionota flaviceps.......... 182
  - nigriceps.......... 181
- Pristoceuthophilus.......... 670
  - celatus.......... 664, 671
  - cercalis.......... 673
  - marmoratus.......... 675
  - pacificus.......... 675
  - salebrosus.......... 675
  - tuberculatus.......... 672
- Probopyrus bithynis.......... 550
- Procyon.......... 145, 146
- Proterhinus Kaalae.......... 478
- Proteus anguineus.......... 378
- Protoberis.......... 494
  - obliteratus.......... 492, 494
- Protocouneus.......... 477
  - punctatus.......... 477

Page.
Protogoniopsis 412
arida 411
Pselliophora ardens 179
compedita 180
rubra 180
Psen (Mimesa) modesta 244
Pseudeuantha 416
linellii 416
Pseudeuphausia latifrons 636, 646
Pseudodinia, flies of the genus, with description of a new species 151
polita 152
Pseudomyothyria tortricis 625
Pseudosida bidentata 541
Pseudosiphona 622
Pseudotelephorus grandis 479
haueri 478
punctulatus 479
Pseudothelphusa angulata 552
clausa 534, 552
pearsei 534, 552
ruthveni 553
Psychoda primaeva 493
Psylla exhumata 487
floccosa 487
Pteronicea aceris 211
winnanae 210
Ptychocheilus lucius 581
Punaclista 406
setosa 407
Punamyia 428
transitionalis 42
Punaphyto 410
tridens 409
Punasarcophaga auromaculata 409
Purpura analoga 567
canaliculata 567
conradi 569
crispata 563
decemcostata 567
emarginata 569
freycinetii 567, 571
var. alabaster 571
lagenaria 569
lapillus 571
var 567
var. anomala 569
beringiana 567
crispata 563
quillayutea 563
lima 567
ostrina 569
plicata 563
rupestris 569
saxicola var 569
septentrionalis 563
Pyonsia picta 455
Pyraustomyia 627
Pyrgulopsis ozarkensis 588
wabashensis 588
Raccoons and their allies, the genera and subgenera of 143
Rana cantabrigensis 353, 354
catesbeiana 353, 354
clamitans 352, 354
esculenta 379
pipiens 352, 354

Page.
Rana septentrionalis 354
temporaria 379
Relics, miscellaneous in the Washington Collection 19
Reptiles and amphibians from Gogebic County, Michigan 351
Rhachocnemis 683
hostiferus 684
validus 684
Rhadinoceraea gracilicornis 209
Rhamphidia ferruginosa 168
flavipes 492
inconspicua 168
niveitarsis 168
(Rhamphidia) apicalis 167
Rhampholimnobia 169
reticularis 169
Rhaphidophora xanthostoma 658
Rhaphidophorinae found in North America, the genera of the tettiginiid insects of the subfamily 655
Rhipidia javanensis 164
(Rhipidia) javanensis 164
Rhombothyriops 419
elegans 420
Rhyssalus niger 67
oscinidis 90
Richardsonius gibbosus 581, 582
orcutti 574
purpureus 582
Rissoa clandestina 55
firmata 38
fortis 40
insiguis 61
janus 47, 60
kelseyi 49
scalariformis 38
scalaris 51
stricta 33
Rissoina, mollusks of the genus, from the west coast of America 33
adamsi 47
bakeri 56
barthelowi 48
burragei 52
californica 55
cerrosensis 59
clandestina 55
cleo 58
contabulata 51
coronadensis 60
dalli 59
dina 45
effusa 54
excolpa 39
expansa 46
firmata 38
flavilla 43
fortis 40
gisna 41
helena 44
histia 51
inca 33, 42
io 44
janus 60
kelseyi 49
lapazana 50

Page.
Rissoina, laurae 52
mazatlanica 43
mexicana 56
nereina 53
newcombei 58
notabilis 51
peninsularis 46
pleistocena 54
signae 61
stricta 39
sulcifera 33
townsendi 48
woodwardii 57
zeltneri 52
Rohwer, S. A., descriptions of new species of hymenoptera 205
Salamander, an albino, Spelerpes bilineatus 377
Salamandra maculosa 378
Salmo irideus 585
Scambrus 225
brunneifrons 225
evetrivorus 225
nigrifrons 225
pterophorae 225
Schistoloma, Philippine land shells of the genus 195
alta mindoroensis 196
pygmaea 196
romblonensis 196
altum 197
(Hololoma) quadrasi 203
coronensis 204
quadrasi 203
mcgregori webbi 196
quadrasi 203
(Schistoloma) alta 197
alta 197
mindoroensis 198
pygmaea 200
romblonensis 199
sibuyanensis 199
mcgregori 200
McGregori 200
tablasensis 201
webbi 202
Schizoneurites 487
brevirostris 488
Sciara gurnetensis 490, 491
lacoei 491
protoberidis 491
splendida 491
Sesarma roberti 553
Shells, bivalve, of the group Anatinacea, from the west coast of America 441
fresh-water, new, from the Ozark Mountains 587
land, of the genus Schistolma, from the Philippine Islands 195
Sipholeskia 628
Siphona brevirostris 622
plusiae 622
Siphonopsis 622
Siphopsalida 439
meridionalis 439
Slossonaemyia 624
Page.
Snyder, John Otterbein, notes on a collection of fishes made by Dr. Edgar A. Mearns from rivers tributary to the Gulf of California 573
Somatochlora semicircularis 336, 344
Somatogyrus crassilabris 588
Spelerpes bilineatus, and albino salamander 377
Sphaerocera sepultula 497
Sphaeroniscus colombiensis 547
gaigei 546
Sphalloglandulus 438
unicus 438
Statues, engravings, and paintings belonging to Washington 1
Stegosaurus, a new restoration of 355
Stenomyites 497
fuscipennis 497
Sterna bergeri 524
bergii 516
boreotis 515, 520, 521
gwendolenae 526
cantiaca 517
caspia 517
cristata 520, 521
hirundo 516
media 517
novaehollandiae 525
pelecanoides 522
poliocera 525
rectirostris 515
Stibadocera bullans 178
metallica 178
Stone, meteoric, notes on the composition and structure of the Indarch, Russia 109
Storeria occipitomaculata 353
Stratiomys brodiei 494
chamaeleon 494
Streptocephalus coloradensis 97
Strix occidentalis, notes on the subspecies of the spotted owl 251
Strix occidentalis caurina 251, 252, 253, 254
huachucae 251, 253, 255, 256
lucida 251, 253, 255
occidentalis 251, 252, 253, 254, 256, 256
Stylocheiron abbreviatum 653
affine 652
carinatum 651
insulare 636
longicorne 652
maximum 653
microphthalma 653
Styringomyia jacobsoni 170
Sympetrum corruptum 289, 329, 331, 333, 337, 345
costiferum 330, 345
madidum 270, 329, 330, 337, 345
obtrusum 329, 330, 331, 337, 345
var. decisum 330, 337, 345
pallipes 266, 329, 330, 331, 337, 345
scoticum 329, 330
semicinctum 330, 338, 345
vicinum 266, 271, 345
Symphoromyia in North America, the dipterous genus 113
atripes 115, 119
barbata 120

Page.

- Symphoromyia cinerea, 121
  - cruenta, 122
  - fulvipes, 123
  - hirta, 124
  - inquisitor, 115, 127
  - inurbana, 127
  - johnsoni, 128
  - kincaidi, 129
  - limata, 131
  - modesta, 132
  - montana, 133
  - pachyceras, 134
  - pilosa, 135
  - plagens, 136
  - plumbea, 138
  - pullata, 138
  - sackeni, 139
  - securifera, 140
  - trivittata, 141
  - trucis, 142
- Syrnium occidentale, 251, 255
  - caurinum, 251, 255
  - lucidum, 251, 253, 255, 256
- Table furnishings belonging to Washington, 8
- Tachina latifrons, 624
- Tenthredella turneri, 207
- Tern, crested, Thalasseus bergii, a synopsis of the races of the, 515
- Tetragoneuria spinigera, 331
- Thais biserialis, 558
  - canaliculata, 568
    - var. analoga, 568
      - compressa, 569
  - columellaris, 558
  - emarginata, 569, 570, 571
    - var. ostrina, 570
  - freycinetii, 567, 570
  - lamellosa, 564, 571
    - var. cymica, 565
      - franciscana, 565
      - hormica, 565
      - neptunea, 565
      - sitkana, 566
  - lapillus, 567
  - lima, 570, 571
  - (Nucella) canaliculata, 567
    - emarginata, 56
    - freycinetii, 57
    - lamellosa, 563
    - lima, 566
  - plicata, 563
  - saxicola, 569
- Thalasseus bergii, a synopsis of the races of the crested tern, 515
  - bengalensis, 517
  - bakeri, 515, 519
  - bergii, 515, 516, 517
    - bakeri, 515, 519
    - bergii, 518, 524, 525
    - cristatus, 520, 521, 522, 525
    - edwardsi, 520
    - gwendolenae, 515, 526
    - halodramus, 522
    - pelecanoides, 517, 521, 522, 523, 524, 525, 526
    - poliocercus, 525, 526
    - thalassinus, 515, 519

Page.

- Thalasseus bergii velox, 515, 519, 525
  - bernsteini, 517
  - cristatus, 524
  - elegans, 517
  - eurygnathus, 517
  - maximus, 517
  - sandvicensis, 517
- Thamnophis sirtalis, 353, 354
- Thescelosaurus, osteology of, an orthopodous dinosaur from the Lance formation of Wyoming, 591
- Thescelosaurus neglectus, 612, 615
- Thracia beringi, 442
  - challisiana, 443
  - colpoica, 443
  - condoni, 443, 447
  - conradi, 442
  - corbuloidea, 442
  - curta, 442
  - diegensis, 443
  - dilleri, 447
  - fabula, 443
  - jacalitosana, 447
  - karquinezensis, 447
  - mactorpsis, 447
  - phaseolina, 444
  - semiplanata, 447
  - squamosa, 444
  - trapezoidea, 442, 447
  - ventricosa, 447
- Thysanopoda aequalis, 639
  - cornuta, 636, 639
  - monocantha, 638
  - orientalis, 639
  - pectinata, 636, 639
  - tricuspidata, 636, 637
- Tigoma intermedia, 582
- Tipula castanea, 182
  - cinereifrons, 187
  - congruens, 182
  - flavicosta, 187
  - fulvolateralis, 183
  - gedehana, 185
  - gedehicola, 189
  - inconspicua, 189
  - javensis, 190
  - limiformis, 492
  - monochrous, 182
  - pedata, 183, 184
  - praepotens, 182
  - salakensis, 189
  - sunda, 186
  - tjibodensis, 188
  - umbrina, 182
  - umbrinoides, 185
- Tipulidae, a collection of Javanese crane-flies, in the United States National Museum, 157
- Tipulodina magnicornis, 183
- Tortriciophaga, 625
- Townsend, Charles H. T., diagnoses of new genera of muscoid flies founded on old species, 617
  - New Neotropical muscoid flies, 405
- Trachomedusae, Eperetmus, a new genus of, 399
- Tricholytia, 633

Page.
Trichodactylus dentatus.................... 534
(Dilocarcinus) dentatus...... 551
pictus........ 552
pictus........................ 534
quinquedentatus............ 534
(Trichodactylus) quinquedentatus................... 552
Triphylite, allophanite, and fuchsite, notes on 463
Trissomalus fulvicornis........................ 233
Tropidischia xanthostoma.................... 658
Tylos latreilli................................ 541
Typhlomolge rathbuni....................... 378
Uca minax................................ 532, 554
mordax.............................. 532, 554
Udeopsylla.................................. 686
compacta......................... 687
devius............................. 688
nigra.......................... 666, 688
robusta........................ 686, 687
Ula javanica................................ 176
Uromacquartia.............................. 626
halisidotae................... 626
Urophyllopsis............................... 625
Ursus cancrivorus........................... 146
lotor................................ 145, 146

Page.
Viverra caudivolvula......................... 149
nasua................................. 147
Walker Expedition to Santa Marta, Colombia, an account of the crustacea collected by the.................................... 531
Washington and Oregon, notes on the life history and ecology of the dragonflies of....... 259
Washington relics in the United States National Museum, descriptive catalogue of... 1
Wherry, Edgar T., a peculiar oolite from Bethlehem, Pennsylvania................. 153
Notes on allophanite, fuchsite, and triphylite.................... 463
Wyoming, Lance formation of, osteology of Thescelosaurus, an orthopodous dinosaur from the 591
Xanthophyto................................. 627
Xeracris 25
minima.............................. 27
Xylocelia.................................... 243
Xyrauchen texanus...................... 579, 581
Zygofrontina................................ 427
capitis........................... 427

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